CanAlt Health Laboratories
242 Applewood Cres., Unit #3 Concord, Ontario - L4K 4E5
416 800-8008 1 877 900-8008 Hair Mineral Analysis

Hair Mineral Analysis

Practitioner	Project# 17606
,	
,	
	Client# 65

Patient: *Sample Report, (SID: 43783)* **Report Date:** February 7, 2022 **Login Date:** December 2, 2021

TOXIC AND NON-NUTRITIONAL

	Result (ug/g)	High Limit	--- Acceptable--- ---------- Above Acceptable Limits ----------	
Mercury (Hg)	0.10	1.00		Hg
Lead (Pb)	0.56	1.00		Pb
Cadmium (Cd)	0.09	0.10		Cd
Arsenic (As)	0.03	1.00		As
Aluminium (Al)	10.59	10.00		Al
Antimony (Sb)	0.04	1.00		Sb
Barium (Ba)	0.52	1.50		Ba
Beryllium (Be)	0.005	0.050		Be

Weighted Total Toxicity Assessment (36)

NUTRITIONAL ELEMENTS

Mainly Structural	Result (ug/g)	Expected (ug/g)	Below Normal Normal Above Normal	
Calcium (Ca)	516	375-875		Ca
Magnesium (Mg)	43	44-98		Mg
Sulphur (S)	42664	35000-55000		S
Silicon (Si)	175	15-300		Si
Boron (B)	0.82	0.5-3.5		B
Phosphorus (P)	156.1	125-250		P
Strontium (Sr)	1.3	0.8-6.0		Sr
Mainly Electrolyte				
Potassium (K)	117.5	10-115		K
Sodium (Na)	117.5	37-370		Na
Mainly CoFactor				
Zinc (Zn)	165.5	140-250		Zn
Copper (Cu)	56.0	12-38		Cu
Iron (Fe)	18.8	6-28		Fe
Selenium (Se)	0.74	0.8-2.0		Se
Chromium (Cr)	0.41	0.2-1.8		Cr
Manganese (Mn	0.230	0.2-0.8		Mn
Nickel (Ni)	0.237	0.15-1.0		Ni
Vanadium (V)	0.018	0.01-0.15		V
Molybdenum (Mo)	0.037	0.03-0.15		Mo
Cobalt (Co)	0.021	0.02-0.20		Co

Results and the bar that is displayed in yellow indicate a high or low borderline result to the normal range

SIGNIFICANT RATIOS

	Result	Expected		Result	Expected
Ca:Mg	12.0	4-20	Ca:Pb	914	>84
Ca:P	3.3	1.5-7.0	Fe:Pb	33.3	>4.4
Ca:K	4.4	2.0-40	Fe:Hg	190.1	>22
Ca:Na	1.9	9.4-134	Se:Hg	7.49	>1.0
Ca:Fe	27.0	21-109	Zn:Hg	1672	>200
Na:K	2.4	2.0-4	Zn:Cd	1761	>800
Na:Mg	6.5	0.2-2.2			
Zn:Cu	3.0	4-17			
Fe:Cu	0.3	0.20-1.5			

OTHER ELEMENTS

The significance of these elements in hair has not been established. Higher than normal values may indicate exogenous sources.

Potentially Toxic

	Result	Expected
Bismuth (Bi)	0.017	<1.0
Palladium (Pd)	<DL	<1.0
Platinum (Pt)	0.003	<1.0
Silver (Ag)	6.747	<1.0
Thallium (Tl)	<DL	<1.0
Uranium (U)	0.007	<1.5
Tungsten (W)	0.002	<2.0

Generally Non-Toxic

	Result	Expected
Lithium (Li)	0.021	<DL - 0.1
Tin (Sn)	0.495	<DL - 2.0
Zirconium (Zr)	0.148	<DL - 0.4
Cerium (Ce)	0.013	<DL - 0.05
Lanthanum (La)	0.011	<DL - 0.05

Normal Type: (1) Female >14 Analysis Date: December 6, 2021

<dl: Below Method Detection Limit NA: No Analytical Data (Suspected Contamination) For use by practitioners only. Not for diagnosis.

INTRODUCTION TO HMA INTERPRETATION

The interpretation of the results in this report is to be used as a guide. Hair mineral analysis is a valuable adjunct to other diagnostic techniques but should not be used in the absence of other information. Each person is biochemically unique and experiences a different environment, thus it is important to employ a range of information ; eg patient history, metabolic type, occupation, symptoms, diet analysis, digestion and absorption status, current supplementation regimen, drug use, etc. It is important to consider each individual element that is outside the normal range, establish the possibility of exogenous sources (eg workplace, hobby), and assess the result in relation to other test results and information. Finally, the patterns and ratios can be used to confirm your conclusions.

This report does not (and could not) provide patient-specific recommendations for nutritional or detoxification protocols because such recommendations require information from numerous sources, as outlined above. As with the interpretation of complex and sometimes conflicting nutritional symptoms, it is sometimes necessary to concentrate on correction of the most significant issues rather than attempt to correct everything at once. Diet and supplementation is a complex issue and must be carried out with consideration of input from and assimilation of dietary nutrients. Many vitamins and minerals interact and an excess of one can cause a deficiency of another. Indeed, this is one of the values of hair analysis: it indicates these balances. Nutrients must work together to be absorbed and utilized effectively.

Hair analysis is widely recognized as a valuable tool for the detection of toxic heavy metals (mercury, cadmium, lead, arsenic, etc.). Research has shown that minerals in hair are reflective of the total nutritional environment, including the input of protein, carbohydrate, fat, vitamins and minerals, as well as the psychological state of the individual; Gershoff [Am. J. Clin. Nutr., 30, 868 (1977)]. Some elements are more reliable than others as indices of body burden and nutritional status.

Exogenous sources can contaminate the hair and cleaning is important during sampling as well as in the lab. Industrial and tobacco smoke, aerosol, antiperspirant, and other air particulate are particularly problematic. We recommend the use of Johnsons Baby or similar mild Shampoo prior to taking the hair sample. The strength of washing procedures and analytical methods may vary from one laboratory to another especially for water soluble elements like sodium and potassium, thus concentration data and 'normal ranges' should not be compared directly [Assarian & Oberleas, Clin.Chem., 23, 1771(1977)]. Despite this difference, the interpretation of the concentration data (relative to 'normal') can be relied upon. The treatment of hair a shampoo like Selsun has a significant influence on trace element values and can render them unreliable. Some hair colouring and shampoo additives are rich in lead, selenium, silicon, boron,and other elements which could contaminate the sample, [McKenzie, Am.j.Clin.Nutr., 31, 470 (1978)].

DETAILED NUTRITIONAL INFORMATION REPORT

The following information is a summary of the known information relating to each individual element found to be outside normal ranges for this person. Extreme care must be taken when assessing this information with respect to a specific person because, in general, a relatively small subset of the information will be relevant. The assessment MUST be carried out in conjunction with other information.

Toxic Elements Introduction

The presence of high levels of toxic elements in the hair is a good indicator of poor nutritional status and can be a major factor in many disease processes. The concentrations of these elements can be determined very accurately. Their significance and effects have been well studied. This is particulalarly true of mercury, lead and cadmium.

Toxic Group 1 Summary

Toxic Group 1 Elements (Mercury, Lead, Cadmium, Arsenic) are within normal limits

Toxic Group 2 Summary

Al Sb Ba and/or Be High: These elements can be toxic but are often deposited on the surface of the hair by

exogenous sources. Hair concentrations are good indicators of body burden. If exogenous sources have been eliminated, appropriate action should be taken to eliminate the ingestion and accelerate the displacement and de-toxification of these elements. Supplementation with selenium, calcium and zinc may help.

Individual Toxic Elements

MERCURY (Hg)

Mercury is in normal range.

LEAD (Pb)

Lead is in normal range.

CADMIUM (Cd)

Cadmium is in normal range.

Arsenic (AS)

Arsenic is in normal range.

ALUMINIUM (Al)

Al High: Elevated concentrations in the brain have been associated with Alzheimer's and Parkinson's diseases. Aluminum has not been shown to be essential to plants or animals. Yet aluminum is commonly ingested in food, medicine and cosmetics. The toxicity of aluminum has only recently been recognized. Previously aluminum was considered to be virtually non-absorbed and was thus widely used in a variety of food additives and over-the-counter drugs such as antacids. Research now suggests that aluminum interferes with normal body processes causing neurological changes such as those recently incriminated in Alzheimer's disease (a form of senility often occurring at a young age), Parkinson's disease, and dialysis dementia.

Relevance of Hair Levels: Hair concentration can be a good indicator of body load but Aluminum is often present as a contaminant and this possibility should be considered. Aluminum is very widespread in the environment (both anthropogenic and natural sources) and can often be present as a result of exogenous contamination. Dr. Jeffery Bland, Professor of Nutritional Biochemistry at the University of Puget Sound in Tacoma, Washington, and Director of the Bellevue-Redmond Medical Laboratory in Bellevue, Washington, has found in his clinical experience that hair aluminum above 60. ppm are highly significant in terms of elevated body burdens, but hair aluminum under 60 ppm are as yet uncertain. CanAlt Laboratories has set a low toxic level at under 10 ppm, borderline toxicity between 10 and 20 ppm, and toxicity above 20 ppm. Dr. Bland has presented in his lectures a case history that concerned a physician's wife who had a routine hair analysis and found that it contained a high aluminum levels. She was taking an aluminum-containing antacid. Upon discontinuing the aluminum-containing antacid, her hair aluminum gradually returned to normal. Recent animal research has been published to further confirm the significance of hair aluminum levels. CanAlt has also observed elevated levels when the body was fighting bacterial infections.

Biochemical Roles: Aluminum is absorbed in the intestine and excreted by the kidneys. In persons with abnormal kidney function, aluminum is deposited in the bones. It may impair kidney function and interfere with liver detoxification reactions. It inhibits the enzyme hexokinase. Recent research has shown that aluminum binds to DNA and deposits in abnormal neurofibrillary tangles in the brain. Aluminum has also been linked to three different types of dementia diseases; senile dementia, parkinson related dementia and dialysis dementia. (Science News 122, 292-293. Nov. 6, 1982).
Aluminum was implicated as a cause of senility, sometimes at an early age, (pre-senile dementia or Alzheimer's disease) in 1977 by a team of researchers led by Dr. Donald Crapper of the University of Toronto. They found four times as much aluminum in the neurons (nerve cells) of senile brains as in the neurons of normal brains. They noted that the aluminum was concentrated in areas of the senile brains that were abundant in neurofibrillary tangles. The tangles are characteristic of senility and presumably "tangle" the nerve transmissions causing confusion and loss of memory.
People who have worked in aluminum smelting plants for long periods have been known to experience dizziness, impaired coordination and loss of balance and energy. The accumulation of aluminum in the brain has been cited as a possible cause for these symptoms. There is evidence to suggest that long term accumulation of aluminum in the brain may contribute to the development of Alzheimer's disease. Intestinal absorption of high levels of aluminum and silicon can result in the formation of compounds that accumulate in the cerebral cortex and prevent nerve impulses from being carried to and from the brain.

Possible Causes: Pathways for aluminium entry to the metabolic system can include use of certain anti-acids, medicines, anti-perspirants, aluminum cookware and utensils, baking powder, processed cheese, drinking water

(particularly soft water) and processed foods containing aluminum additives. There is debate over how much aluminum is added to foods by cooking in aluminum pots and pans or by wrapping in aluminum foil. Possible dangers from aluminum cookware appear occasionally in medical journals but are usually dismissed as being insignificant. Aluminum cookware is subject to destruction by acid and alkaline foods, but this source of aluminum in the diet is relatively small. The contribution from additives such as sodium aluminum sulfate in baking powder and cheese, potassium alum in white flour, and others, as well as antacids are the major dietary sources.
Patients being treated with kidney dialysis may have elevated aluminium. Chronic calcium deficiency can aggravate the passage of Aluminum into the body.
It has been estimated that the average person ingests between 3 and 10 milligrams of aluminum a day. Aluminum is the most abundant metallic element in the earth's crust. It is absorbed into the body primarily through the digestive tract, but also through the lungs and skin, and is absorbed by and accumulates in body tissues. Because aluminum permeates our air, water, and soil, it is found naturally in varying amounts in nearly all food and water. Aluminum is also used to make cookware, cooking utensils, and foil. Many other everyday products contain aluminum as well, including over-the-counter painkillers, anti-inflammatory agents, and douche preparations. Aluminum is an additive in most baking powders, is used in food processing, and is present in products ranging from antiperspirants and toothpaste to dental amalgams to bleached flour, grated cheese, table salt, and beer (especially when packaged in aluminum cans). One prominent source of aluminum is our municipal water supplies because Alum (a compound of Aluminum) is often added as a flocculant.
The excessive use of antacids may be the most common cause of aluminum toxicity in this country, especially by people who have kidney problems. Many over-the-counter antacids contain amounts of aluminum hydroxide that may be too much for the kidneys to excrete successfully. Even antacids containing a mixture of aluminum and other ingredients may pose a problem; in some people, such products may cause the same reaction as products composed entirely of aluminum compounds.

Signs & Symptoms: Elevated aluminium concentrations can be associated with impaired calcium metabolism (formation of bone and teeth) and/or thyroid function. Many of the symptoms of aluminum toxicity are similar to those of Alzheimer's disease and osteoporosis. Aluminum toxicity can lead to colic, rickets, gastrointestinal disturbances, poor calcium metabolism, extreme nervousness, headaches, decreased liver and kidney function, forgetfulness, speech disturbances, memory loss, softening of the bones, and weak, aching muscles. Because aluminum is excreted through the kidneys, toxic amounts of aluminum may impair kidney function. The accumulation of aluminum salts in the brain has been implicated in seizures and reduced mental faculties. To reach the brain, aluminum must pass the blood-brain barrier, an elaborate structure that filters the blood before it reaches this vital organ. Elemental aluminum does not readily pass through this barrier, but certain aluminum compounds, such as aluminum fluoride, do. Many municipal water supplies are treated with both alum (aluminum sulfate) and fluoride, and these two chemicals readily combine with each other in the blood. Moreover, aluminum fluoride, once formed, is very poorly excreted in the urine.

Supplementation: Additional dietary calcium and magnesium is particularly important, along with supplementation of zinc, B-6, and vitamin C may help to lower aluminium levels.

Other Information: It is important to support digestive and kidney function so as to increase elimination. A detox program of appropriate severity and designed for the individual, may be warranted based on hair analysis along with other confirmatory information.

Antimony (Sb)

Antimony is in normal range.

BARIUM (Ba)

Barium is in normal range.

BERYLLIUM (Be)

Berillium is in normal range.

Mainly Structural

These elements play a major role in the formation and maintenance of the skeleton, teeth and connective tissue.

CALCIUM (Ca)

Calcium is in normal range.

MAGNESIUM (Mg)

Mg Low: Low levels often (but not always) indicate low intake or malabsorption and these should be considered. Inadequate dietary levels are common: most people receive less than 2/3 RDA. Low levels can cause Calcium deposits in soft tissue, including kidney stones. Older people are particularly susceptible to deficiency and malabsorption. Some researchers believe that low Magnesium is a major factor in heart disease and some cancers.

Relevance of Hair Levels: Magnesium concentration in hair correlates with nutritional intake and metabolic status in a complex manner. Levels can be low in the hair even though sufficient levels are present in the body. This can be due to a number of factors including the presence of excess Calcium. Low levels should be interpreted along with symptom analysis and other tests. Grey hair has generally lower levels.

Biochemical Roles: Magnesium is a major mineral in the body (~30 gm). It functions as a structural element but one of its primary functions is enzyme activation. Approximately 60 percent of the magnesium in the body is bone, 26 percent is muscle, and the remainder in soft tissue and body fluids. The tissues with the highest magnesium concentration are those that are the most metabolically active (brain, heart, liver, and kidney)--thus magnesium's critical role in energy production. It is present in high levels in mitochondria (energy production) and is ~18x more concentrated in the heart than in the blood, where it regulates heart-beat (it acts as a Calcium channel blocker). Calcium is a muscle stimulator whereas Magnesium is a muscle relaxant (a natural tranquilizer). As with Calcium, the bones act as a reservoir for Magnesium. It decreases blood coagulation, is essential for most enzyme activity (particularly carbohydrate metabolism) and directly affects the metabolism of Potassium, Calcium, and vitamin D. It is an electrolyte and an enzyme activator. It is necessary for nerve conduction, protein synthesis and for the release of energy and is required to allow muscles to relax after contraction. The parathyroid, which regulates blood Calcium levels, requires Magnesium. It promotes healthy teeth by holding Calcium in the enamel.
Magnesium is critical to many cellular functions, including energy production, protein formation, and cellular replication. Magnesium participates in more than 300 enzymatic reactions in the body, in particular those processes involved in energy production (i.e. production of ATP). Magnesium is also required for the activation of the sodium and potassium pump that pumps sodium out of, and potassium into, the cells. Therefore, magnesium deficiency results in decreased intracellular potassium. Magnesium has been referred to as "nature's calcium channel blocker" because of its ability to block the entry of calcium into vascular smooth muscle cells and heart muscle cells. As a result, magnesium supplementation can help reduced vascular resistance, lower blood pressure, and lead to more efficient heart function. Magnesium also helps regulate proper calcium metabolism through its actions on several hormones including parathyroid hormone and calcitonin.
Some conditions which benefit from magnesium supplementation are: asthma and chronic obstructive pulmonary disease, cardiovascular disease, acute myocardial infraction, angina, cardiac arrhythmia, cardiomyopathy, congestive heart failure, high blood pressure, intermittent claudication, low HDL-cholesterol levels, mitral valve prolapse, stroke, diabetes, eosinophilia-myalgia syndrome, fatigue, fibromyalgia, glaucoma, hearing loss, hypoglycemia, kidney stones, migraine, osteoporosis, pregnancy (toxaemia, premature delivery, and other complications), premenstrual syndrome, and dysmenorrhoea.
Magnesium can help heal cardiovascular illness, chronic fatigue syndrome, and muscle cramps. It can also help prevent kidney stones.
Magnesium aids in bone and muscle growth; it is required to avoid poor calcium and potassium balance; helps lower the risk of getting osteoporosis as well as possible cardiovascular disease.
Magnesium is a vital catalyst in enzyme activity, especially the activity of those enzymes involved in energy production. It also assists in calcium and potassium uptake. A deficiency of magnesium interferes with the transmission of nerve and muscle impulses, causing irritability and nervousness.
Magnesium is necessary to prevent the calcification of soft tissue. This essential mineral protects the arterial linings from stress caused by sudden blood pressure changes, and plays a role in the formation of bone and in carbohydrate metabolism. With vitamin B6 (pyridoxine), magnesium helps to reduce and dissolve calcium phosphate kidney stones, and may prevent calcium-oxalate kidney stones. Research has shown that magnesium may help prevent cardiovascular disease, osteoporosis, and certain forms of cancer, and it may reduce cholesterol levels. It is effective in preventing premature labour and convulsions in pregnant women.

Possible Causes: Insufficient intake, B6 deficiency, diabetes, exposure to toxic materials, over-intake of aspirin, caffeine, or alcohol. Acid-Balance (alkalosis / acidosis), laxative use, gastrointestinal disorders, chemotherapy,

alcoholism, protein malnutrition, diuretics, toxic elements, drugs, chemotherapy, and kidney malfunction can be factors in low Magnesium concentrations. Hyperparathyroid and hyperadrenal conditions are sometimes associated with low levels. Other conditions associated with or causing magnesium deficiency are: acute pancreatitis; congestive heart failure; dietary deficiency; digitalis toxicity; excessive sweating; impaired intestinal absorption (this includes chronic diarrhoea, ileal resection, and malabsorption syndromes); increased magnesium loss through kidneys (this includes diuretic use, diabetes, antibiotics, alcohol, hyperthyroidism, and kidney disease).
Dietary deficiencies of magnesium are unusual, but can occur after prolonged vomiting, diarrhoea, alcohol abuse, or long-term use of diuretics. They can also occur if a person has a severe protein deficiency. High intakes of calcium can increase the excretion of magnesium and can lead to problems if unchecked.

Signs & Symptoms: Insomnia, predisposition to stress, poor digestion, abnormal heart rhythms and other cardiovascular problems, muscle pain and weakness, high blood pressure, PMS, menstrual cramps, depression, anxiety, kidney stones, hyperactivity, and chronic fatigue (particularly if Potassium levels are inadequate).
Magnesium deficiency can also lead to a loss of muscle control by causing muscles to remain contracted. Nervousness, irritability and tremors are other symptoms. A deficiency of magnesium may also be the cause of hallucinations in people undergoing alcohol withdrawal. Diabetics are often deficient in Magnesium.
Magnesium deficiency is extremely common, particularly in the geriatric population and in women during the premenstrual period. Deficiency is often secondary to factors that reduce absorption or increase secretion of magnesium, such as high calcium intake, alcohol, surgery, diuretics, liver disease, kidney disease, and oral contraceptive use.
Low magnesium levels are common in the elderly, but most cases go unnoticed because most physicians rely on serum magnesium to indicate magnesium levels. Most of the body's magnesium store lies within cells, however, not in the serum (non cellular portion of blood). A low magnesium level in the serum reflects end-stage deficiency. A more sensitive test of magnesium status is the level of magnesium within the red blood cell (erythrocyte magnesium level).

Supplementation: Supplementation should be balanced particularly with Calcium (typically 1:3 ratio but higher levels of Magnesium may be warranted for short periods) along with the following synergistic nutrients: Vitamins A, B1, B2, B3, B6, D, C, Potassium, Zinc, Manganese, Phosphorus, Chromium. Magnesium aspartate or gluconate are absorbed better than the sulphate or carbonate. Magnesium supplementation may be far more important for many people. Many nutritional experts feel the ideal intake for magnesium should be based on body weight (6 milligrams per 2.2 pounds body weight). For a 110-pound person, they recommend 300 milligrams; for a 154-pound person, 420 milligrams; and for a 200-pound person, 540 milligrams. People with kidney disease or severe heart disease (such as high-grade atrioventricular block) should not take magnesium (or potassium) except by physician's orders. In general, magnesium is very well tolerated; however, magnesium supplementation--particularly magnesium sulfate (Epsom salts), hydroxide, or chloride--sometimes causes a looser stool.
Supplementing the diet with magnesium aids in maintaining the body's proper pH balance and normal body temperature. Magnesium, calcium, potassium, and other minerals interact extensively, and dosages of other minerals reduce the intake of magnesium and vice versa. Vitamin B6 works together with magnesium in many enzyme systems and increases the intracellular accumulation of magnesium. A high calcium intake and a high intake of dairy foods fortified with vitamin D result in decreased magnesium absorption. There are many drugs that adversely effect magnesium status, particularly many diuretics, insulin, and digitalis.
Magnesium supplementation may be helpful for people who have allergies, backache, chronic fatigue syndrome, diabetes, heart problems, fibromyalgia, glaucoma, high cholesterol, headache and migraine, hemorrhoids, high blood pressure, kidney stones, osteoporosis, Parkinson's disease, and PMS. Because magnesium can compete with other minerals for absorption, it is best to get your magnesium in a multivitamin-mineral supplement and/or with your calcium supplement.

RDA's Foods and Other Info: RDA is between 250 and 400 mg depending on age and sex. Dietary sources include hard water, wheat bran, cheese, red meat, salmon, beans, lentils, nuts, and milk. It is present in chlorophyll, thus green vegetables are a good source. B-vitamins help to improve and regulate Magnesium utilization. People with high Magnesium in their drinking water experience a lower incidence of sudden death from heart attack. The RDA for magnesium is 350 milligrams per day for adult males and 280 milligrams per day for adult females. Larger amounts are needed in women who are pregnant or breast feeding. An extra 20 mg per day in addition to 280 mg is recommended for pregnant women. In the first six months of lactation, an extra 75 mg per day is recommended, and in the second six months an additional 60 mg per day is enough to replenish the magnesium lost to breast milk. Since magnesium occurs abundantly in whole foods, many nutritionists and dietitians assume most people get enough magnesium in their diets. Most people, however, do not eat whole, natural foods; they consume large quantities of processed foods. Because food processing refines out a very large portion of magnesium, most people do not get the RDA for magnesium. The best dietary sources of magnesium are tofu, legumes, seeds, nuts, whole grains, and green leafy vegetables. Fish, milk, meat, and most commonly eaten fruits are quite low in magnesium.

Most people consume a low magnesium diet because their diets are high in refined foods, meat, and dairy products. Magnesium can be found in soybeans, whole grains, molasses, clams, and some shellfish such as clams and oysters. Magnesium can also be found in these food sources: liquid milk (both cow and goat), cheddar cheese, honey, eggs, beef, chicken, beef heart, beef liver, mutton, pork, clams, cod, oysters, shrimps (boiled), canned salmon, peanuts, almonds, brazils, cashews, bananas, blackberries, dried dates, dried figs, grapefruit, oranges, prunes, raspberries, broccoli, cabbage, carrots, celery, sweet corn, kale, dried lentils, fresh peas, dried peas, potatoes, dried soybeans, spinach, white flour, whole wheat flour, rye flour, white bread, wholemeal bread, white rice, brown rice, semolina, and yeast (compressed baker's and dried brewer's).
The consumption of alcohol, the use of diuretics, diarrhoea, the presence of fluoride, and high levels of zinc and vitamin D all increase the body's need for magnesium. The consumption of large amounts of fats, cod liver oil, calcium, vitamin D, and protein decrease magnesium absorption. Fat-soluble vitamins also hinder the absorption of magnesium, as do foods high in oxalic acid, such as almonds, chard, cocoa, rhubarb, spinach, and tea.

SULPHUR (S)

Sulphur is in normal range.

SILICON (Si)

Silicon is in normal range.

BORON (B)

Boron is in normal range.

PHOSPHORUS (P)

Phosphorus is in normal range.

STRONTIUM (Sr)

Strontium is in normal range.

Mainly Electrolyte

These elements participate in many hormone actions and assist in maintaining equilibrium and homeostasis.

POTASSIUM (K)

K High: Over intake from dietary sources is rare. Sodium / Potassium ratios are more informative than hair concentration levels. Elevated potassium occurs when it exceeds the sodium level in hair and may be an indication of long term stress.

Relevance of Hair Levels: Hair concentrations of Potassium correlate loosely with nutritional status and blood concentrations may be necessary to confirm electrolyte imbalance. However, blood levels of potassium reflect neither total body content nor clinical status. Sodium / Potassium ratios are more informative than hair concentration levels. Most of the body's potassium stores are in cells, so high free potassium in the serum (the portion of the blood containing no blood cells) or hair usually occurs only in extreme potassium oversupply. The best test for determining the body's potassium stores is the red-blood-cell potassium level. Caution in reviewing results from different laboratories as electrolytes are water soluible and the lab procedures used to wash the hair prior to analysis may cause the reported concentrations to varry . Ratios of the electrolytes should not be affected.

Biochemical Roles: Adults normally contain more than twice as much potassium as sodium (typically 9. oz versus 4. oz). It is the major cation inside cells. About 98 percent of total body potassium is inside the cells. Intracellular fluid has a potassium content more than thirty times the potassium concentration of the fluid surrounding the cells. The sodium-to-potassium ration is 1:10 inside the cell and 28:1 in the extra cellular fluid (2/1 in the hair). This concentration of potassium within the cells is not achieved by simple diffusion through the cell membrane. It is achieved by an energy-consuming process called the "sodium-potassium pump". This pump is in the membranes of all body cells, and one of its most important functions is preventing cellular swelling. If sodium is not pumped out, water accumulates in the cell, causing it to swell and ultimately burst. The sodium-potassium pump also functions to maintain the electrical charge within the cell. This is particularly important to muscle and nerve cells. During nerve transmission and muscle contraction, potassium exits the cell and sodium enters, which results in an electrical charge change. This change causes a nerve impulse or muscle contractions, so it is not surprising that a potassium deficiency affects muscles and nerves first. As a result of this mechanism, the amount of potassium in the bloodstream or in hair may not accurately reflect the proper distribution or total supply of body

potassium. The sodium-potassium pump through the cell membranes may also help other nutrients enter the cell. Magnesium helps hold potassium within the cells.

Although more than 90 percent of ingested potassium is absorbed from the gastrointestinal tract, the blood level remains relatively contract despite wide variations in intake. Regulation of body potassium is dependent on the system that also maintains sodium balance. It's distribution (intra/extra cellular) is linked to insulin, aldosterone, and alkalosis. It is critical to maintaining heartbeat and participates in numerous enzyme functions. People on diuretics must be very careful to maintain adequate Potassium levels. Unlike Sodium, Potassium exerts a positive effect on hypertension in most people. Low levels may be associated with electrolyte imbalance and/or adrenal insufficiency (often caused by chronic stress) and confirmatory adrenocortical tests should be used. It is excreted through the GI tract, skin and urine. Potassium can be excreted via the gastrointestinal tract, but this loss is small except during diarrhoea or kidney failure. Skin losses of potassium are trivial. Large volumes of sweat lead to only modest potassium losses. The kidney and associated endocrine system are the major regulatory mechanism controlling potassium balance. Potassium works closely with sodium to regulate blood pressure, water levels, muscle tone, and other functions.

Potassium plays a major role in maintaining electrolyte balance, and cell integrity. It facilitates a wide variety of enzyme reactions. Although sodium and chloride are important, potassium is the most important dietary electrolyte. In addition to functioning as an electrolyte, potassium is essential for conversion of blood sugar into glycogen, the storage form of blood sugar in the muscles and liver. A potassium shortage results in lower levels of stored glycogen. Because exercising muscles use glycogen for energy, a potassium deficiency produces great fatigue and muscle weakness, the first signs of potassium deficiency.

Potassium is unique in that it is an electrolyte, meaning it is capable of conducting electricity, and is crucial for brain function. However, serious injuries and prolonged stress can counteract the effectiveness of this mineral. When the potassium level in the hair is higher than the sodium level it is an indication of prolonged stress.

Potassium is involved in the use of amino acids and there is evidence that it is also involved in bone calcification. Skeletal muscle contains six times more potassium than sodium. A high-potassium/low sodium diet has been found to normalize blood pressure in patients having elevated blood pressure. After going off the high-potassium / low-sodium diet, the patients again contracted high blood pressure.

Blood sugar provides fuel for our immediate energy needs. When energy needs increase, the first energy reservoir is glycogen stored in muscles and liver. Glycogen is made from blood sugar and is the only fuel stored as carbohydrate. Because glycogen is carbohydrate, it can be quickly summoned from storage and converted back to blood sugar (glucose). There is a limit to how much glycogen can be stored in muscle and liver. Once these reserves are filled, extra energy is stored as fat. Fat is more compact and can be stored in its own special containers--fat cells. However, the conversion from fat back to blood sugar involved many steps and is comparatively slow and inefficient. Potassium is essential for the conversion of blood sugar into glycogen. A potassium shortage results in lower glycogen reserves and limited available energy and also means that less blood sugar is utilized for conversion to glycogen; thus there is a tendency to high blood sugar and increased insulin need (even to overproduction of insulin, resulting in low blood sugar). High blood sugar is not energy-sustaining because it is quickly consumed when increased energy is needed or it is converted to fat by the increased blood levels of insulin. Energy sustenance requires a quick-acting, long-lasting reservoir.
Possible Causes: High concentrations generally indicate electrolyte regulatory problems rather than excessive dietary potassium. High levels can be associated with high levels of toxic elements. The relationship of potassium to other elements is an important assessment of overall endocrine balance.

Possible Causes: Dehydration and over supplementation are possible causes. High concentrations of Potassium usually occur with high concentrations of Sodium. If only Potassium is elevated, then excessive perspiration, salt water swimming may be the cause. If both Sodium and Potassium concentrations are elevated, then this may be indicate adrenal function problems (adrenocortical hypoactivity). Symptom assessment should be used to verify this. When levels of potassium are higher than sodium it could be an indicator of long tern stress.

Signs & Symptoms: Early signs of Potassium toxicity are nausea and diarrhoea and irregular heartbeat. Kidney failure, dehydration and adrenal insufficiency can elevate blood potassium to toxic levels. Potassium salts can cause nausea, vomiting, diarrhoea, and ulcers when given in pill form at high-dosage levels. Sudden increases in intake of potassium to levels about 18. grams per day may result in cardiac arrest. If both sodium and potassium concentrations are high, then this may be indicate adrenal function problems (adrenocortical hypoactivity).

S**upplementation:** There are no highly effective supplementation programs to reduce Potassium levels however

the following nutrients may be of limited benefit: Vitamins B1, B5, B6, E, Sodium, Magnesium, Manganese, Zinc, Phosphorus, Iron. Supplementation should not be considered for people with heart problems or for infants. Magnesium helps to maintain intracellular potassium levels. High Sodium increases excretion of Potassium and vice versa. Many practitioners recommend supplementation of Potassium (100. - 200. mg/day) and vitamins C (3. - 10. gm/day), B5 (800. - 1200. mg/day) when hypo-endocrine function is a problem.

RDA's Foods and Other Info: RDA is between 2. and 3. grams. Potassium is widely distributed in foods: fruit and fruit juice, quash, parsley, peanut butter, dried apricots raisins, beans, spinach, soybeans, raisins, chard, potato, and milk contain high levels. Fish and most FRESH UNCOOKED vegetables provide some Potassium. Buckwheat contains 450. mg potassium per 100 gm, and contains essentially no sodium. Bananas are often recommended, not because they are particularly high in Potassium but because they are available and are enjoyed by most people. Other sources are: cheddar cheese, cottage cheese, cream cheese, processed cheese, natural yogurt, eggs, honey, beef, pork, bacon, canned ham, chicken, liver, kidney, fresh haddock, herring, kipper, canned salmon, potatoes, Brussels sprouts, cauliflower, fresh peas, frozen peas, canned peas, mushrooms, oranges, orange juice (fresh and frozen concentrate), lemons, lemon juice, grapefruit, grapefruit juice, apples, apple juice, grapes, grape juice, dried dates, tomato juice, cooked prunes, white bread, wholemeal bread , wheat germ, and yeast (compressed baker's and dried brewer's).
Typical diets supply 3. - 7. grams of sodium compared to only 1.5 to 5. grams of potassium. Primitive diets and unprocessed food diets consumed in non-industrialized nations normally supply the body with more Potassium than Sodium.

Diets consisting largely of processed foods tend to have an undesirable potassium-sodium balance. The ideal solution is to replace much of the over-salted foods with potassium-rich natural foods. The second best advice is to balance the potassium-sodium ratio by cutting back on salt added at the table and taking potassium supplements. Both goals can be obtained simultaneously by replacing table salt (sodium chloride) with a salt substitute (potassium chloride). "Light or Sea salts" contain half potassium chloride and half sodium chloride. It is important to consider Sodium to Potassium ratio when designing diet. Too much sodium in the diet often leads to disruption of this balance.

Numerous studies demonstrate that a low-potassium, high sodium diet plays a major role in the development of cancer and cardiovascular disease (heart disease, high blood pressure, strokes, etc.). Conversely, a diet high in potassium and low in sodium protects against disease. In the case of high blood pressure, it can even be therapeutic. Most people have a potassium-to-sodium (K: Na) ratio of less than 1:2. This 1:2 ratio means most people ingest twice as much sodium as potassium. Researchers recommend a dietary potassium-to-sodium ratio of greater than 5:1 to maintain health. This is ten times higher than the average intake. The average K:Na ratios of some common fresh fruits and vegetables with high K:Na ratios is as follows: apples, 90:1, bananas, 440:1, carrots, 75:1, oranges, 260:1, potatoes, 110:1

Studies show that a diet low in potassium and high in sodium (salt) increases the risk of heart disease, stroke, and high blood pressure. This imbalance is particularly critical if you have kidney disease or high blood pressure or if you are taking certain medications, such as ACE inhibitors or potassium-sparing drugs.
Most people can handle an excess of potassium. The exception is people with kidney disease; they do not handle potassium in the normal way and may experience heart disturbances and other consequences of potassium toxicity. Individuals with kidney disorders usually need to restrict their potassium intake and follow the dietary recommendations of their physicians.

SODIUM (Na)

Sodium is in normal range.

ENDOCRINE EVALUATION

Electrolyte levels suggest normal adrenal and normal thyroid function.

Sodium / Potassium Ratio is within normal range.

Mainly CoFactor

These elements participate in thousands of biochemical / metabolic reactions.

ZINC (Zn)

Zinc is in normal range.

COPPER (Cu)

Cu High: Copper is an essential element but it is extremely important to keep levels within optimal limits. At elevated levels copper may be considered a toxic element.

Relevance of Hair Levels: Hair concentration is a good indicator of nutritional status and body loading but copper is often present as a contaminant from hair treatments, swimming pools and industrial sources. Blood analysis is a good confirmation for Copper status. Published scientific research by L.M. Kelvay, in a number of medical journals, indicates a statistically significant correlation between liver copper and hair copper at the 99.9 percent confidence level. An exception has recently been established by Epstein which indicates that in primary biliary cirrhosis of the liver and perhaps in other liver diseases, hair copper does not correlate with liver copper. It is necessary to verify hair copper evaluations by assuring that the subject has a healthy liver. This emphasizes the fact that hair analysis results MUST be integrated with other information.

Biochemical Roles: About 75. to 100. mg of copper is in the body (range 50 to 120 mg) with about one-third of that fairly evenly divided between the liver and brain, one-third in the musculature, and the remaining third dispersed in other tissues. More than a dozen enzymes have been found to contain copper. The best studied of the more than one dozen copper-containing enzymes are superoxide dismutase, cyctochrome C oxidase, catalase, dopamine hydroxylase, urincase, tryptophan dioxygenase, lecithinase and other monoamine and diamine oxidases. Copper, itself, is catalytic in the oxidation of vitamin C, and there are indications that an enzyme yet to be isolated, ascorbate oxidase, contains copper. It is essential to life and is found in all body tissues. Copper helps the body absorb and use iron. It is part of several enzymes that help form hemoglobin (the oxygen-carrying pigment in red blood cells) and collagen (a connective tissue protein). Copper plays a vital role in the formation of hemoglobin and collagen (structural matrix). Integrity of bone, skin, cartilage, and tendons depends on Copper. It is important to the properties of elastin (the connective tissue that enables flexibility in skin, blood vessels and lungs. It is required for the formation of myelin that insulates and protects nerve cells. It is vital to detoxification of many chemicals by the liver. It is most highly concentrated in blood, liver, kidneys and brain. It is essential for release of energy and control of free-radical activity (with Superoxide Dismutase, SOD). Copper is essential as a cofactor for some enzymes (particularly those requiring its oxygen-handling ability) eg SOD and lysyl oxidase. Copper is bound to ceruloplasm which is produced in response to an inflammation like arthritis.
Absorption of copper occurs primarily in the stomach and upper small intestine. Absorption is probably mostly due to simple diffusion, although an undetermined amount of copper may be transported through the intestinal walls by metallothionein which also may transport zinc and cadmium. This would explain their antagonistic relationship.

Copper is used to help heal anaemia because it helps transport iron and form hemoglobin, the red-blood-cell component that takes oxygen from the lungs to all other parts of the body. It helps maintain the myelin sheath covering of nerves. Copper is also an antioxidant. Unbound from proteins and enzymes, however, copper is a free radical in the body that may cause cancer. Too much zinc can cause a deficiency of copper. It is especially important that this mineral be taken in proper balance with zinc and other minerals. Much of the earlier research on copper dealt with how copper promotes iron absorption and utilization. Several attractive mechanisms that explain copper's essential role in iron absorption, transport and incorporation into red blood cells have been proposed, but the question of how it is accomplished is unresolved. However, the function of copper in maintaining the integrity of the cardiovascular system may be more important than its role in forming red blood cells. Copper-deficient animals and people having a genetic defect impairing copper utilization (Menkes' disease) have twisted blood vessels and massive internal hemorrhages. This probably results from a collagen protein defect in the blood vessels. Copper-deficient aortas contain less "mature" elastin and a higher proportion of soluble collagen than normal.
Absorbed copper is transported in combination with albumin to the liver where the copper is then incorporated into a blue protein called ceruloplasmin.

The liver controls copper storage and excretion of Copper. Excess copper is excreted via the bile, although as the copper intake increases, the amount retained also increases. The amount of copper stored in the liver is pproximately 30. percent of the total body copper content. About 80. percent of copper excretion is via the bile, about 15 percent diffuses into the intestine, and the remainder is excreted in the urine. Copper is needed for vital cross-linking of molecules of protein such as collagen and elastin together to form firm tissue and blood vessels.

Possible Causes: High dietary or supplemental intake. High levels may indicate an inability to excrete excess Copper, liver disease (hepatitis/cirrhosis), or kidney problems. The use of oral contraceptives and/or tobacco can cause a rise in the amount of copper in the body. Excess serum copper can be associated with anaemia, cirrhosis of the liver, leukemia, hypoproteinemia, and vitamin B3 (niacin) deficiency. Serum copper levels tend to be higher than normal during pregnancy as well. Wilson's disease is a rare hereditary disorder in which the body is unable to

metabolize copper properly, so the metal accumulates in the body. However, increased hair levels of Copper CANNOT be used to imply Wilson's (or any other) disease. People with diminished adrenal gland function or abnormally slow metabolisms can develop high copper levels.

A deficiency of zinc, especially when combined with a high copper intake, can cause too much copper to build up in the tissues. In addition, stress can cause a decrease in the amount of zinc available to the body, which can lead to copper overload.Drinking water from pipes made of copper may also cause copper toxicity. Dr. Carl Pfeiffer has shown that in some suburban homes, individual water systems where the well water is usually acid can produced copper intoxication. He cites a home in Peapack, New Jersey where the well water had 0.03 parts per million copper, the upper bath had 0.32 ppm and an outside faucet had 1.62 ppm. In the house, only the upper bathroom tap had drinkable water by the U.S. Public Health Service standards which set a maximum of 1. ppm copper. Dr. Pfeiffer also cites an Australian report of copper intoxication leading to the death of a fourteen month-old child. The well water was in the acid pH range (4 as opposed to neutral at 7) and copper plumbing was used. The water contained nine to ten times the suggested maximum copper content.

Signs & Symptoms: Symptoms include fatigue, joint pain, anaemia, muscle cramps, PMS, nerve damage, nervousness, depression, mood and behavioural problems. Ingesting a quantity as small as 10. milligrams may cause nausea. Sixty milligrams generally results in vomiting, and just 3.5 grams (3,500 milligrams) can be fatal. Children can be affected at much smaller dosage levels.
At high doses (10. mg or more), nausea, vomiting, muscle pain, and stomach pain may occur. Some experts believe excessive copper may be linked with autism and hyperactivity. Excessive copper may also cause damage to joint tissues. Elevated hair copper may also result from external contaminations. Industrial sources are common and many swimming pools are treated with Copper salts.

Supplementation: Zinc is particularly useful as a means to balance Copper excess. Others are Calcium and Magnesium, vitamin C, black tea. A dietary (high in phytates and fibre) and mild detox approach may be helpful. A liver and systemic detox often results in normalization of Copper levels.

RDA's Foods and Other Info: RDA is 1. - 3. mg and optimal levels for adults are slightly higher. Copper is widely distributed in foods. Good dietary sources are milk (cow and goat), eggs, beef, pig liver, calf liver, duck, goose, pork, canned ham, cod, haddock, halibut, lobster, oysters, canned salmon, shrimps (boiled), brazil nuts, hazelnuts, peanuts, beans (various), carrots, dried lentils, peas (fresh), potatoes, spinach, apricots, bananas, blackberries, dried dates, dried figs, olives, oranges, pears, dried raisins, strawberries, white bread, wholemeal bread, rye bread, oat flakes, rice, wheat germ, honey, and both compressed baker's and dried brewer's yeast. Many fruits and vegetables are poor sources however, fresh vegetables and amino acids may increase copper absorption. Vitamin C, antacids, Iron, black tea, and phytates inhibit the uptake of Copper
.
The estimated safe and adequate intake of copper for adults is 1.5 to 3. milligrams. Since nutrients like zinc and vitamin C interfere with copper absorption, a popular dosage recommendation for copper is based on zinc intake. The optimal ratio of zinc to copper is 10:1. This ratio means that if zinc is supplemented at a dosage of 30 milligrams per day, it requires a dosage of 3 milligrams of copper. However, when using zinc supplementation for specific treatment at dosages between 30. to 90. milligrams, it is not usually recommended that copper be taken at a level greater than 3. milligrams. When using long-term, high dose zinc therapy (more than 45. milligrams per day), it is a good idea to monitor LDL- and HDL-cholesterol levels. If significant alterations occur, reduce the zinc dosage or increase the copper dosage. The Copper of food is extremely variable so diet assessment is a problem.

IRON (Fe)

Iron is in normal range.

SELENIUM (Se)

Se Low: Selenium Dietary deficiency is quite common. Large areas of north America are deficient in soil selenium levels. This is true especially for the east and west coasts including large parts of Ontario. Soil deficiency usually translates into human deficiency as the water and crops grown in these regions have low concentrations in selenium.

Relevance of Hair Levels: Hair levels of Selenium are indicative of nutritional status. Selenium is an essential element that is normally found at very low concentrations in hair. Anti-dandruff shampoos (Selsun) contain high concentrations of selenium which becomes tightly bound to hair causing an erroneously high reading.

Biochemical Roles: The total-body content of selenium in an average adult is less than a milligram with major portions of that concentrated in the liver, kidney, testicles, spleen and pancreas but selenium is found in all body tissues. The normal blood level of selenium is 21. to 23. micrograms per 100. millilitres, mostly transported via the alpha- and beta-globulins.
The absorption of selenium seems to be efficient (44. - 70. percent), but the mechanism is unknown. Excretion is principally in urine although a small fraction is excreted in the feces, and a trace is lost in the breath. Homeostasis is achieved by the regulation of urinary selenium excretion. Selenium absorption and fecal excretion are not regulated. Selenium is found as selenocysteine (it replaces sulphur) which is found in high concentrations in erythrocytes, platelets, cytoplasm and liver mitochondria. Its main nutritional role is 'protection' and immune system enhancement.

Selenium is an essential component of glutathione peroxidase which protects the body from a vast array of toxins including free radicals and heavy metals, particularly Mercury. Selenium and glutathione peroxidase levels are low in patients with rheumatoid arthritis, eczema, and psoriasis and may be low in most inflammatory conditions. Because free radicals, oxidants, prostaglandin, and leukotrienes cause much of the damage to tissues seen in rheumatoid arthritis, a deficiency of selenium results in even more significant damage because of low levels of glutathione peroxidase. Glutathione peroxidase is especially important in reducing the production of inflammatory prostaglandin and leukotrienes.

Selenium activates Vitamin E in its protection against oxidation-induced cellular damage, including cardiac toxicity of drugs, aging pigment, peroxidation of fats and blood haemolytic problems. It is essential as a cofactor in thyroid hormone action and hypothyroidism may be associated with low Selenium (Nature: 349: pp438-440, 1991) and high Mercury. Many studies have indicated that Selenium plays an important role in protecting against heart disease, cancer, and asthma. A high percent of cancer victims have low levels of selenium in their hair. There is evidence that a deficiency of Selenium can cause heart disease. Low selenium concentrations have been associated with pancreatic (exocrine) insufficiency and resulting protein malabsorption.

Many studies have shown that the lower the intake of selenium, the higher the incidence of cancer of the colon, breast, pancreas, ovary, bladder, prostate, rectum, skin, and lungs. In a recent study (Environ Health Prev Med, 14,261,2009) Selenium has an inverse correlation with cancer (higher levels of selenium - lower levels of cancer). Other conditions that have been reported to respond to supplementation with selenium include AIDS, allergies, arteriosclerosis, cataracts, macular degeneration, multiple sclerosis, and rheumatoid arthritis.

Selenium also helps maintain normal liver function and protein synthesis; it plays a role in male reproductive capacity (sperm count), and helps maintain healthy eyes, hair, and skin. It is used in solutions or shampoos as selenium sulfide for the treatment of common fungal infections demonstrates it's effectiveness for this application.

Selenium is necessary for the health of the heart and other muscle. It has been reported to improve the function of mitochondria (the energy-producing units of cells) by protecting them from lack of oxygen. This may account for the fact that selenium supplementation has been found to be effective in the treatment of chest pains associated with heart disease (angina pectoris). Selenium is also required for the production of a specific type of hormone-like substance called prostaglandin, which, among other things, helps regulate blood pressure.

Selenium may play a pivotal role in whether some viruses live harmlessly in the body or turn into pathogens that kill. Laboratory studies at the University of North Carolina at Chapel Hill first suggested that selenium is the switch that triggers a Jekyll-and-Hyde personality in viruses. Subsequent studies at the University of Georgia in Athens indicated that selenium depletion in a cell may be what throws a switch on HIV, the virus that causes AIDS. Studies in Africa show that when the diet of HIV positive patients is suplemented full blown AIDS does not develop.

Selenium's ability to enhance immune function was demonstrated in a study where individuals with normal selenium concentrations in their blood received selenium supplementation of 200. micrograms per day. This resulted in a 118. percent increase in the ability of lymphocytes to kill tumour cells and an 82.3 percent increase in the activity of a white blood cells (T-cells). These effects were speculated to have resulted from the ability of selenium to enhance the expression of the immune-enhancing compound interleukin-2. This in turn increased the rate of white blood cell proliferation and differentiation into forms capable of killing tumour cells and microorganisms. The supplementation regimen did not produced significant changes in the blood selenium levels of the participants. It increases the ratio of HDL to LDL cholesterol and inhibits platelet aggregation, particularly in smokers.
Selenium protects cells against damage from free radicals. Selenium and vitamin E have been shown to work well together to reduce free radical damage.

Possible Causes: Low concentration of selenium is usually due to low intake caused by the regular food chain

being low in selenium. Malabsorption and the presence of high levels of toxic metals, particularly Mercury, Lead and Cadmium, can be major factors. Over-supplementation with vitamin E can also be a factor.

Signs & Symptoms: Deficiency of Selenium has been associated with alpaca (hair loss), muscle weakness, high cholesterol, liver impairment, certain cancers, cardiovascular disease and impaired immune function. Some of the therapeutic uses are: arthritis, hypothyroidism, chronic fatigue, arteriosclerosis prevention, cancer prevention, immunodeficiency, cataract prevention, MS, and heavy metal toxicity. Deficiency symptoms are sometimes hard to detect because vitamin E can substitute for selenium in some of its functions, thus masking some of the classic deficiency symptoms may suggest an increased risk of degenerative diseases and increased risk of toxic element accumulation (particularly Arsenic, Mercury, Cadmium, and PCBs).
Severe selenium deficiency is associated with Keshan disease, a severe heart disorder that affects primarily children and women of childbearing age. Keshan disease appears in some areas of China where selenium levels are very low. Kashin-Beck disease is an arthritic condition that is also linked to low selenium levels in China. In extreme cases, Selenium deficiency can cause other heart disturbances and muscle weakness.

Supplementation: The window of safe levels of selenium is narrow, and therefore supplementation should be approached cautiously. The daily intake should not exceed 150 micrograms and high levels of supplementation should not be sustained for long periods: 50. ug (micrograms) per day is generally accepted as safe. NB! supplementing at higher levels than 200. ugs may be TOXIC. Supplementation should be balanced with the following nutrients: Vitamins A, B1, B3, B6, B12, D, E, C, Copper, Iron, Manganese, Calcium, Sodium and Potassium. Vitamin E levels should be correlated with Selenium levels. Vitamin C increases uptake.

Selenium is available in several different forms. Studies show inorganic salts like sodium selenite are less effectively absorbed (will not increase levels in the hair)and not as biologically active as organic forms of selenium, such as selenomethionine and selenium-rich yeast. Therefore, the preferred form of selenium supplement is either selenomethionine or high-selenium-content yeast. L-selenomethionine is the major form in food.

Selenium supplementation should be considered as part of any post-heart attack or stroke plan. In one double-blind study, 81 heart attack patients were randomly assigned to receive 100 micrograms of selenium (from selenium-rich yeast) or a placebo. After 6 months, there were 4 fatal and 2 nonfatal heart attacks in the placebo group compared to no deaths and 1 nonfatal heart attack in the selenium group.Clinical studies have not yet clearly demonstrated that selenium supplementation alone improves the signs and symptoms of rheumatoid arthritis; however, one clinical study indicates that selenium combined with Vitamin E does provide significant benefit.

Some nutritionists say that a natural form of selenium, called L-selenomethionine or selenium-rich yeast, is superior to synthetic form. This has not been proven. Typical dosage is 50. ug (micrograms) daily. Higher doses are not recommended except for special cases and while under the direct case of a health care professional.

CAUTION : At high-intake levels selenium can produce toxicity. Although Selenium is an essential element at low concentrations, it is 10 times more toxic than arsenic at high levels.

RDA's Foods and Other Info: RDA is 40. - 70. ug (micrograms) but suggested optimal levels are in the 60. - 200. ug range (food plus supplementation). Requirements increase with age. Dietary sources include foods grown in selenium-rich soil brazil nuts(the highest concentration by far), whole grains, brewers yeast, garlic, sunflower seeds, meat and marine fish. The amount found in grains depends upon the level of the mineral found in the soil in which they were grown. In addition, the selenium content of animal products varies with the selenium content of the diet fed the animals. Thus the foods vary markedly from region to region in their selenium content, and food tables are unreliable. The best approach is a varied diet. Most fruits and vegetables are low in Selenium.

CHROMIUM (Cr)

Chromium is in normal range.

MANGANESE (Mn)

Manganese is in normal range.

NICKEL (Ni)

Nickel is in normal range.

VANADIUM (V)

Vanadium is in normal range.

MOLYBDENUM (Mo)

Molybdenum is in normal range.

COBALT (Co)

Cobalt is in normal range.

Significant Ratios

These ratios and the patterns that they and the individual elements (above) form can be indicative of biochemical and metabolic imbalances.

Calcium / Magnesium (Ca / Mg)

Calcium / Magnesium (Ca/Mg) ratio is in normal range.

Calcium / Phosphorus (Ca / P)

Calcium / Phosphorus (Ca/P) ratio is in normal range.

Calcium / Potassium (Ca / K)

Calcium / Potassium (Ca/K) ratio is in normal range.

Calcium / Sodium (Ca / Na)

Ca/Na Low: Fast Oxidizer-high energy with excessive adrenal and thyroid function or can be caused by acute stress (high sodium).

Calcium / Iron (Ca / Fe)

Calcium / Iron (Ca/Fe) ratio is in normal range.

Sodium / Potassium (Na / K)

Sodium / Potassium (Na/K) ratio is in normal range.

Sodium / Magnesium (Na / Mg)

Na/Mg High : The ratio reflects adrenal function. An ideal ratio is about 4/1. A High Sodium / Magnesium ratio may indicate an overactive adrenal gland : high energy levels. It may also be caused by elevated Sodium levels. Sodium levels may be elevated by elevated cadmium, copper, mercury, iron or nickel. Individuals under acute stress have elevated Sodium levels in the hair. Reduced Magnesium levels in association with high Sodium generating an elevated ratio is often seen with A type personalities. Overactive adrenal function will produce the following symptoms - tendency to inflammatory reactions, increased stamina / drive, agressiveness, impulsiveness, hypertension, and diabeties.

Zinc / Copper (Zn / Cu)

Zn / Cu Low: A ratio often related to mental function. Reduced Zinc-to-Copper ratio has been associated with copper toxicity leading to behavioural changes and mood swings, as well as hyperthyroidism or low Zinc levels that are associated with impotence, slow healing, loss of taste, smell, appetite and hair loss. High copper levels are seen in ADD / ADHD cases. Individuals taking exogenous steroids or birth control pills may have a reduced ratio. Serum cholesterol is generally lower in these individuals. A low Zinc level (generating a low ratio) will reflect a weaken immune system and when combined with a high copper level will cause depression, fatigue, menstral difficulties, PMS, and skin problems.

Iron / Copper (Fe / Cu)

Iron / Copper (Fe/Cu) ratio is in normal range.

Toxic Ratios

Calcium / Lead (Ca / Pb)

Calcium / Lead (Ca/Pb) ratio is in normal range.

Iron / Lead (Fe / Pb)

Iron / Lead (Fe/Pb) ratio is in normal range.

Iron / Mercury (Fe / Hg)

Iron / Mercury (Fe/Hg) ratio is in normal range.

Selenium / Mercury (Se / Hg)

Selenium / Mercury (Se/Hg) ratio is in normal range.

Zinc / Mercury (Zn/Hg)

Zinc / Mercury (Zn/Hg) ratio is in normal range.

Zinc / Cadmium (Zn/Cd)

Zinc / Cadmium (Zn/Cd) ratio is in normal range.

Other Potentially Toxic Elements

These elements can be toxic in certain circumstances. High levels in the hair can indicate industrial or environmental exposure. The biochemistry of these elemets is poorly understood and we are monitoring the literature.

Bismuth (Bi)

Bismuth (Bi) is in normal range.

Thallium (Tl)

Thallium (Tl) is in normal range.

Palladium (Pd)

Palladium (Pd) is in normal range.

Tungsten (W)

Tungsten (W) is in normal range.

Platinum (Pt)

Platinum (Pt) is in normal range.

Uranium (U)

Uranium (U) is in normal range.

Silver (Ag)

Ag High: Hair concentration can be an accurate indicator of body load but silver is often present as a contaminant from hair treatments, swimming pools (algaecides) and industrial sources. It may inhibit collagen formation. It is used in many industrial processes. Silver is not an essential element and most of its compounds are of low toxicity. However some compounds are very toxic. Sources include: marine fish, photographic processes, solder, exhaust from coal fired power plants, some water filtration units ('activated' carbon) and colloidal silver products. Silver is easily absorbed by the skin so wearing silver jewelry will produce elevated levels but not necessarily toxic levels. Silver from dental amalgams is measurable in the hair.

Other NonToxic Elements

These elements are generally nontoxic. The role of these elemets is poorly understood and we are monitoring the literature. When significant findings are published we will include them in this report.

Lithium (Li)

Lithium (Li) is in normal range.

Tin (Sn)

Tin (Sn) is in normal range.

Germanium (Ge) is in normal range.

Zirconium (Zr)

Zirconium (Zr) is in normal range.

Analytical Methodology

Hair mineral analysis has been in use for more than 30 years Hair Tissue Mineral Analysis: An Emergent Diagnostic Technique: Jeffrey Bland, Publ Northwest Diagnostics 1980. Analytical technology and methodology has improved dramatically during this time and when analysis is carried out by a reputable laboratory using appropriate technology, along with effective quality control and assurance systems, the analysis of hair produces accurate and precise results. However, hair analysis methodology has not been internationally standardized. The International Atomic Energy Agency published a procedure for sample preparation IAEA Report, IAEA/RL/50, Vienna, 1978. The earliest attempt at method standardization was published by the Hair Analysis Standardization Board, Cranton, Bland et al,. J. Holistic Medicine, 4, 11 1982.

Our laboratory has carried out an exhaustive development of the hair analysis method. It is based on the well accepted technology of Inductively Coupled Plasma Source Mass Spectroscopy. Calibration of the method has been

carried out using at least two internationally recognized standards N.I.S.T. for each element and is validated by analysis of Certified Reference Material CRM. Standardization of the instrumentation is carried out under rigorously controlled conditions. Sources of determinate error have been accounted for and quality control QC procedures are in place for each of these sources of error. Quality assurance QA procedures have been developed to document the quality of the method.

Please Note: This information is for the exclusive use of health care practitioners and is not intended for diagnosis, prophylasix or treatment. It should be used in conjunction with other information including patient history, symptom assessment and diet / nutritional assessment.

Thank you for choosing our services. We value your business and welcome any suggestions you may have.

BIBLIOGRAPHY

1 Trace Element Hair Analysis and Nutrition; Richard A. Passwater PhD, Elmer M. Cranton MD, Keats Publ. 1983
2 Modern Nutrition in Health and Disease, 9th ed; Shils M.E., Olsen J.A., Shike M., Ross A.C., Lippincott Williams & Wilkins 1999
3 Nutrition: Concepts and Controversies 7th Ed; Frances Sizer, Eleanor Whitney, West/Wadsworth Publ. 1997
4 The Calcium Factor; Robert R. Barefoot, Carl J. Reich, MD, Deonna Enterprizes Publ 1998
5 Minerals and Your Health; Dr. Len Mervyn, Keats Publ. 1984
6 Nutrition and Physical Degeneration; W. Price, Keats Publ. 1938
7 Encyclopedia of Nutritional Supplements; Michael T. Murray ND, Prima Publishing 1996
8 Smart Guide to Vitamins & Healing Supplements; Ruth A. Ricker, PhD, John Wiley & Sons 1998
9 Encyclopedia of Nature's Vitamins & Minerals; Dr. John Heinerman, Prentice Hall Press 1998
10 The Healing Power of Minerals; Paul Bergner, Prima Publishing 1997
11 Guide To Body Chemistry & Nutrition; Dr. Bernard Jenson, Keats Publ. 2000
12 The Natural Healing Companion; Dr. Deborah A. Wiancek, Rodale Publ. 2000
13 Trace Elements in Human and Animal Nutrition 4th Ed.; Underwood, E.J., Academic Press 1977
14 Prescription for Nutritional Healing, 3d ed.; P.A. Balch CNC, J.A. Balch M.D., Avery Publ. 2000
15 Complete Book of Vitamins and Minerals, A. McDonald PhD, R.D., A. Natow PhD, R.D., J.Heslin M.S., R.D., Publications International 1994
16 The New Nutrition, Dr. Michael Colgan, Apple Publishing 1995
17 Healing With Vitamins, Editors of Prevention, Rodale Press 1996
18 Cell Therapy: A new dimension of medicine; Franz Schmid, OTT Publishers 1983
19 Understanding Nutrition, 8th ed; Whitney E.N., Rolfes S.R., West/Wadsworth 1999