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

Practitioner **Project# 4121**

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Client# 65

Patient: **Report Date: March 3, 2014** **Login Date: February 27, 2014**

TOXIC AND NON-NUTRITIONAL

	Result (ug/g)	High Limit	--- Acceptable--- / ---------- Above Acceptable Limits ----------	
Mercury (Hg)	0.91	1.00		Hg
Lead (Pb)	0.29	1.00		Pb
Cadmium (Cd)	0.01	0.10		Cd
Arsenic (As)	0.05	1.00		As
Aluminium (Al)	7.31	10.00		Al
Antimony (Sb)	0.08	1.00		Sb
Barium (Ba)	0.53	1.50		Ba
Beryllium (Be)	0.002	0.050		Be

Weighted Total Toxicity Assessment (28)

NUTRITIONAL ELEMENTS

	Result (ug/g)	Expected (ug/g)	Below Normal / Normal / Above Normal	
Mainly Structural				
Calcium (Ca)	1157	200-630		Ca
Magnesium (Mg)	138	18-78		Mg
Sulphur (S)	34127	35000-50000		S
Silicon (Si)	92	15-80		Si
Boron (B)	9.49	0.5-3.5		B
Phosphorus (P)	153.0	125-250		P
Strontium (Sr)	4.4	0.8-6.0		Sr
Mainly Electrolyte				
Potassium (K)	669.8	10-80		K
Sodium (Na)	1799.3	25-180		Na
Mainly CoFactor				
Zinc (Zn)	146.0	140-200		Zn
Copper (Cu)	15.9	10-35		Cu
Iron (Fe)	14.3	6-15		Fe
Selenium (Se)	0.97	0.8-2.0		Se
Chromium (Cr)	0.69	0.2-1.2		Cr
Manganese (Mn	0.230	0.2-0.8		Mn
Nickel (Ni)	0.129	0.15-1.0		Ni
Vanadium (V)	0.003	0.01-0.15		V
Molybdenum (Mo)	0.044	0.03-0.15		Mo
Cobalt (Co)	0.010	0.02-0.20		Co

SIGNIFICANT RATIOS

	Result	Expected		Result	Expected
Ca:Mg	8.4	4-20	Ca:Pb	3922	>84
Ca:P	7.6	1.5-7.0	Fe:Pb	48.6	>4.4
Ca:K	1.7	9.4-135	Fe:Hg	15.8	>22
Ca:Na	0.6	3.8-44	Se:Hg	1.06	>1.0
Ca:Fe	81.0	21-109	Zn:Hg	161	>200
Na:K	2.7	2.0-4	Zn:Cd	14600	>800
Na:Mg	13.0	0.2-2.2			
Zn:Cu	9.2	4-17			
Fe:Cu	0.9	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)	0.077	<1.0
Palladium (Pd)	0.206	<1.0
Platinum (Pt)	0.000	<1.0
Silver (Ag)	0.054	<1.0
Thallium (Tl)	0.002	<1.0
Uranium (U)	0.018	<1.5
Tungsten (W)	0.001	<2.0

Generally Non-Toxic

	Result	Expected
Germanium (Ge)	0.075	<DL - 0.8
Lithium (Li)	0.133	<DL - 0.1
Tin (Sn)	0.120	<DL - 2.0
Zirconium (Zr)	1.813	<DL - 0.4
Lanthanum (La)	2.360	<DL - 0.05
Cerium (Ce)	3.484	<DL - 0.05

Normal Type: (2) Male >14

Analysis Date: March 3, 2014

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

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Practitioner:

Sample Login date: Login Date: February 27, 2 ***Alvin Sebastian, (SID: 9187)*** **Practitioner Copy**

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. In this regard, the use of 'standard patterns' can be used as a guide but are generally unreliable if used as 'rules' for interpreting the results. 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. It is important to design a diet with a wide variety of unprocessed foods, particularly fruits, vegetables, nuts, healthy fats and whole grains while avoiding foods that impair nutrient absorption like soft drinks and caffeinated products, refined sugar, animal fat, deep fried, and highly refined foods.
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. This report provides this information for each element based on current research. The science of hair mineral analysis and interpretation continues to develop and we welcome any insight that you may have.
Hair grows at a rate of 1 - 2 cm/month; thus a sample of hair represents a time-averaged picture of mineral metabolism. For proper sample procurement, the hair for mineral analysis should be head hair taken from the closest 2 - 3 cm (approximately one inch) of growth from the scalp at the nape of the neck. Hair can be inhomogeneous with respect to certain elements (particularly those present at low concentrations). In order to average out this inhomogeneity it is important to take a sufficiently large sample (as specified in our sample submission document).
Exogenous sources can contaminate the hair and cleaning is important during sampling as well as in the lab. Industrial and tobacco smoke, aerosol 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, 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 by bleaching or other treatments has a significant influence on trace element values and can render them unreliable. Some hair colouring and shampoo additives are rich in lead, selenium, zinc, manganese, nickel, and other elements which could contaminate the sample, [McKenzie, Am.j.Clin.Nutr., 31, 470 (1978)].

HOW TO READ THE REPORT

1st PAGE: The elements are arranged from most important (the toxic elements), on the top section of the report, to the elements that have unknown nutritional function and/or which are generally indicative of industrial or exogenous sources. Between these two are the "Mainly Structural","Mainly Electrolyte", and "Mainly Co-Factor" elements. If the concentration of an element is below or above the normal range, the color of the observed result and associated graphic bar will change. Some elements in hair are more reliably linked to nutritional status or body burden. The colors reflect this: red is used for the most toxic elements, dark red for toxic elements that are less dangerous, magenta for nutritional elements that are well correlated with nutritional status, and finally dark yellow for those elements that are not as significant. Thus the 1st page can be read from top to bottom and from red to yellow. If there is no red or magenta on the first page, then the nutritional status of this patient (with respect to minerals) is probably good. Red at the top of the page indicates the need for additional testing or for an action to be taken. Yellow indicates the need for caution and perhaps dietary, lifestyle, or supplementation regimen changes. 2nd PAGE: The second page summarizes some of the causes and nutritional information for elements (Toxic and Nutritional) with observed concentrations higher or lower than normal. This provides a quick and easy way for practitioners to assess the findings and integrate them into their decision process regarding this patient. SUBSEQUENT PAGES: The subsequent pages provide detailed nutritional information about each element (Toxic, Nutritional and Other Elements) with observed concentrations higher or lower than normal. This provides the practitioner with the latest nutritional information about each element. It is the responsibility of the practitioner to decide what information is relevant to the specific patient. The information can be used to identify more complex nutritional conditions and to formulate a dietary or supplement program. It may also be used, with guidance from the practitioner to help educate the patient about the importance of minerals. The information is organized in the following manner: Low/High Element, Reliability of Hair Concentrations, Biochemical Role, Possible Causes, Supplementation Information, Symptoms, RDA's Upper Limits Foods.

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

Toxic Group 2 Elements (Aluminium, Antimony, Barium, Berillium) are within normal limit

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)

Aluminium is in normal range.

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)

High Ca: Elevated calcium levelsin the hair indicate that the body is excreting calcium via the urine/ hair which may be due to an undesirable transfer of this element from bones and teeth to soft tissue ie maldistribution. This redistribution is often accompanied by elevated Strontium in the hair and can be associated with acidosis. It is rare for elevated calcium levels to be associated with too much calcium in the diet but supplementation levels should be closely monitored and included with food levels.

Relevance of Hair Levels: Calcium levels in hair correlate with nutritional intake and metabolic status in a complex manner, thus interpretation of high Calcium levels in hair should be done along with an assessment of dietary intake, absorption factors, drug intake and other information like bone density measurement, dietary analysis, parathyroid / calcitonin hormone status and symptom analysis. Grey hair has generally lower levels. Calcium levels can be elevated from exogenous sources (eg hard water, bleaching, dyes and other treatments). These treatments should not be used for at least 4 weeks prior to sampling hair.

Biochemical Roles: Calcium is the most abundant mineral in the body (~1200 gm). The parathyroid regulates blood levels which must be tightly controlled to maintain vital functions like heartbeat. It is concentrated in the bones and teeth (with phosphorus as hydroxyapatite crystallized on the protein collagen). Other locations are pancreas and cartilage. It is found in low concentrations in the brain and liver. Bone is not 'permanent' and is in a constant flux of deposition and loss. Even a very slight drop in Calcium levels in the blood result in an immediate loss from bones which act as a 'bank'. If the balance is disturbed towards chronic Calcium loss from bones then periodontal disease, osteoporosis or osteomalacia (bending) can result, particularly if 'peak bone mass' occurred very early in life or was very low. In addition to its structural roles, it is necessary for muscle contraction (Magnesium is a muscle relaxant) and therefore for heartbeat, immune and hormone function. It regulates the transport of ions across cell membranes and is particularly important in nerve transmission. It helps maintain normal blood pressure. It is essential for secretion of many hormones, digestive enzymes and neurotransmitters. It plays an important role in the clotting of blood. The parathyroid regulates blood levels which must be tightly controlled to maintain vital functions like heartbeat. Calcium is absorbed mainly in the duodenum/small intestine and requires acid conditions. Vitamin D is essential for Calcium absorption.

Possible Causes: The cause of high Calcium in the hair can be high intake of Calcium, excess vitamin D or A, but maldistribution is more common. Sub clinical hyperparathyroidism can be a cause. Ingestion of too much phosphate (soft drinks & processed food) can carry Calcium out of the blood forcing mobilization from bone (and deposition in soft tissue). If Calcium alone is high then the cause may be related to allergies or food intolerance. If both Calcium and Magnesium are elevated then metabolic acidosis may be the cause. This is particularly likely if the person consumes large amounts of phosphate containing foods (eg preserved foods, soft drinks). Other factors causing high hair Calcium values are stress, lack of exercise, small or large intestine malfunction and high levels of toxic elements. Absorption decreases with age, lack of exercise, excess fat or protein consumption, excess fibre (if eaten with Calcium), oxalates (spinach, rhubarb), phytates (whole grain, seeds, nuts, legumes), caffeine, and alcohol. Thyroid hormones can cause excessive excretion of Calcium.

Signs & Symptoms: Elevated levels in the hair are associated with hypoglycemia, arteriosclerosis, osteoarthritis and/or periodontal disease. Periodontal disease is often one of the first signs of osteoporosis because the alveolar (jaw) bones are robbed of Calcium early on in the process. Tooth sockets widen allowing bacterial inflammation. Other symptoms include confusion, high blood pressure, increased sensitivity of eyes and skin to light, thirst, muscle pain, and dermatitis. A severe deficiency of vitamin D, with the resulting loss of Calcium, causes rickets. Signs of overdose include constipation, muscle spasms, gas, bloating, and calcium kidney stones.

Supplementation: Levels of Phosphorus and Magnesium as well as vitamin D intake should be considered when making recommendations for supplementation. The nerve-muscle role of Calcium is partnered with Magnesium so Magnesium is usually supplemented along with Calcium. Up to 1500. mg per day can usually be tolerated. People with hyperparathyroidism, kidney disease, irregular heartbeat, or cancer should not take Calcium by itself. Calcium is also not recommended for people with chronic constipation, colitis, inflammatory bowel conditions, or diarrhoea. If taken with high levels of Calcium supplements, Vitamin A can stimulate bone loss. Potassium supplements should not be taken at the same time as Calcium as irregular heartbeat can occur. Calcium interferes with the absorption of antibiotics (eg tetracycline). Vitamin E supplementation is often combined with Calcium, particularly if muscle cramps are observed. Regular exercise (particularly compression) assists in the deposition of Calcium. Supplementation should be balanced with the following nutrients: Vitamins A, D, E, B12, C, Folic Acid, Magnesium, Phosphorus, Copper, Sodium, Potassium, and Manganese. Lactobacillus and digestive enzymes assist absorption. Protein deficiency lowers absorption but excess protein (>95 gm) inhibits absorption (perhaps due to the increase of Phosphorus).

People not getting at least 800 milligrams of calcium a day--ideally, 1,500 milligrams for women in a multimineral pill--may want to consider taking extra calcium in the form of calcium lactate. This form consists of calcium bound to lactic acid, thus creating an organic form of calcium from an inorganic mineral. Calcium from natural sources, such as oyster shell and dolomite, is not likely to be as potent.
Several studies indicate some calcium supplements may contain substantial amounts of lead. Lead is a toxic metal that primarily affects the brain, kidney, and red blood cell manufacture. In 1981, the FDA cautioned the public to limit its intake of calcium supplements derived from dolomite or bone meal because of the potentially high lead levels in these calcium supplements. However, recent studies show that other calcium sources, such as bone meal, carbonate and various chelates, may also contain high amounts of lead.
Avoid natural oyster shell calcium, dolomite, and bone meal products unless the manufacturer provides reasonable assurance that lead levels are negligible. Although refined calcium carbonate has the lower lead content, the body absorbs calcium chelates more efficiently.
The absorption of calcium depends somewhat on the calcium becoming ionized in the intestines. Calcium ionization is a major problem with calcium carbonate, the most widely used calcium supplement. In order for calcium carbonate to be absorbed it must first be solubilized and ionized by stomach acid.
Some researchers express concern that increased calcium supplementation may result in increased calcium oxalate kidney stones. Calcium citrate appears to bypass this justifiable concern. Although urinary calcium rises in patients consuming calcium citrate, some of citrate's effects inhibit the formation of kidney stones. Specifically, citrate can reduce urinary saturation of calcium oxalate and calcium phosphate and retard the nucleation and crystal growth of calcium salts.
Taken with vitamin C, calcium is said to help cure colds by increasing the absorption of the vitamin C.
Calcium interferes with the absorption of antibiotics such as tetracycline and ciprofloxacin as well as iron and zinc. Antibiotics may decrease calcium absorption. Calcium may enhance digitalis toxicity.

RDA's Foods and Other Info: RDA's vary (800 - 1500 mg) depending on sex and age. Milk, yogurt, eggs, bread, wheat germ,

soy, potatoes, apples, dates, sardines, halibut, beans, broccoli, cheese, cashews and almonds are good dietary sources. The highest levels among diary sources of calcium is dairy products. Most fruits and vegetables are poor sources but tofu, kale, spinach, turnip greens, and other green leafy vegetables contain Calcium. Calcium from spinach is poorly absorbed, but kale is an excellent source of absorbable calcium. In fact, the rate of calcium absorption from kale is superior to that of milk. Since ounce for ounce kale is higher in calcium that milk, it is a good alternative. Other members of the cabbage family (turnip, collard, and mustard) are as beneficial as kale. A compound called oxalic acid, present in high concentration in spinach, beet greens and rhubarb, combines with the calcium present and makes it unavailable for absorption from the food. The outer husks of cereal seeds and some vegetables contain a substance called phytic acid, which also inhibits calcium absorption by rendering it insoluble. However, recent research indicates that neither oxalic acid nor phytic acid has great importance in preventing calcium absorption assuming that calcium intake is high enough. Constant use of laxatives speeds the movement of food through the gut with consequent lower absorption of calcium.

MAGNESIUM (Mg)

Mg High: Elevated magnesium concentrations usually occur along with high calcium levels and usually indicates maldistribution rather than excessive intake. High levels should be interpreted along with symptom analysis and other tests.

Relevance of Hair Levels: Magnesium concentration in hair correlates with nutritional intake and metabolic status in a complex manner. Levels can be high in the hair even though sufficient levels are present in the body. This can be due to a number of factors including hormonal imbalance causing a mobilization from the hard to the soft tissue. 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 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 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.
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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 level. It is effective in preventing premature labour and convulsions in pregnant women.

Possible Causes: Redistribution can result from chronic stress, toxic element load, or Calcium/Phosphorus imbalance (high Magnesium with low Ca/P ratio is associated with hypoglycemia). If Calcium levels are low then, excess magnesium may be caused by excessive magnesium ingestion but this is rare and is usually due to supplementation, enhanced turnover of bone, kidney disorders or deficiencies of calcium. If both Calcium and Magnesium are elevated then metabolic acidosis may be the cause. This is particularly likely if the person consumes large amounts of phosphate containing foods (eg preserved foods, soft drinks). Elevated body levels are rare but may be associated with central nervous system problems, carbohydrate metabolism, hormone regulation, renal and auto-immune problems. Toxicity has been reported in older people who consume excess laxatives, antacids, and other medications.

Signs & Symptoms : Lack of coordination, insomnia, confusion, and coma have been reported. Excessive magnesium, which can mean as little as 350 to 500 mg for some people, can cause diarrhoea. People with kidney disease should avoid Magnesium supplements.

Supplementation: Most people do not get adequate levels of Mg in their diet. People with high Magnesium in their drinking water experience a lower incidence of sudden death from heart attack. 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. If you take too much magnesium, it can also cause calcium deficiency--so the two minerals should always be taken in balance.

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 also 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)

S Low: Low Sulphur levels may be associated with high toxic element levels (particularly Mercury) in the body.

Relevance of Hair Levels: The evidence supporting hair as an index for Sulphur status in the body is small but some evidence exists. Sulphur is found mainly in the sulphur containing amino acids (cystine, homocysteine, glutathione, methionine, taurine). A large percent of the protein in hair is made up of these amino acids, thus the concentration of sulphur in hair is normally quite high. Perms affect Sulphur concentrations in the structure of the hair and, if used, make the interpretation impossible.

Biochemical Roles: The body does not use Sulphur directly as a nutrient: it is always utilized as part of other essential nutrients like B-vitamins (biotin, thiamin) and protein; it's role is largely to cause proteins to assume a particular shape. This is critical for enzyme function and explains why these are compromised when metal toxicity is present: Sulphur reacts with Mercury, Lead and Cadmium, thus causing these enzymes to malfunction. Sulfur is found throughout the body, especially in the skin, hair, and nails. Sulfur is involved in the storage and release of energy. It is part of the genetic material of cells, and it helps to promote enzyme reactions and blood clotting. Sulfur also combines with certain toxic materials that enter the body so they can be passed out safely in the urine. Sulfur is needed by the body for making essential amino acids. Sulfur can heal the buildup of toxic substances in the body by binding with and eliminating them. Enough sulfur can change a sallow complexion by putting a glow in it, and it may increase low energy. Sulfur springs--water high in sulfur content--have been said to help heal the pain of arthritis. As part of many amino acids, sulfur is crucial to the structural health of the body. It is usually present in mineral-complex supplements. Ruminant animals can make organic sulfur compounds out of sulfate, but we are dependent on plants and other animals to incorporate sulfur into amino acids, such as methionine, cysteine, cystine and taurine. Methionine is an essential dietary nutrient.
Sulfur-containing amino acids are vital to many enzymes and structural proteins. Evidence indicates that people tend to consume proportionally lower dietary amounts of sulfur-containing amino acids as they age, and as a result, aging people may have less than optimal amounts of sulfur-containing amino acids in their bones. Vegetarians may also have low sulfur-containing amino acid intakes, especially if they avoid eggs. Sulfur is also combined with the proteins that structure cartilage, tendons and bone in the body as well as with the proteins in our hair and nails.

Possible Causes: In most cases a high level of Sulphur in hair is related to the condition and treatment of the hair rather than general nutritional status. Rarely, a vegetarian or other highly specialized diet may cause low values. Sulphur is particularly important for heavy metal detoxification: low levels may signify an inability to eliminate these elements.

Signs & Symptoms: Sulphur aids in bile secretion and blood clotting, gives luster to hair, and contributes to a healthy complexion. These latter two observations are probably better indicators of the nutritional status of Sulphur.

Supplementation: Direct supplementation is not generally required and food sources are recommended. A diversity of protein and essential fatty acids is particularly important.

RDA's Foods and Other Information: There is no RDA. Food sources of sulphur include garlic, broccoli, milk, cheese, grains, brussels sprouts, dried beans, cabbage, egg yolk, fish, meat, onions, soybeans, turnips, nuts, dried peas, beans and wheat germ. Sulfur is also part of two B vitamins, biotin and thiamin. It has been found that when protein intake is adequate, sulfur intake is usually adequate as well. This is because sulfur-containing amino acids (the building blocks of protein) supply the body with the amount of sulfur it needs. However, taking in sulfur from other sources preserves these amino acids for other functions.

SILICON (Si)

Si High: Silicon is generally regarded as nontoxic. High levels are rarely due to dietary intake but may result from excessive supplementation. Action should not be taken unless levels are very much higher than normal. High concentrations of silicon may cause impaired kidney function. Too much silicon--above 50 milligrams a day--may contribute to Alzheimer's disease. In fact, along with aluminium, traces of it have been found

in the brains of those afflicted with this disease.

Relevance of Hair Levels: There is inadequate data to establish the relationship between hair levels of Silicon and nutritional status. Despite this lack of published scientific data there is a common opinion among clinicians who measure hair silicon that those patients with higher hair silicon are more resistant to injury and generally exhibit better health for their age than patients with lower hair silicon. The evidence is anecdotal and of unproven scientific significance. High levels in hair may reflect elemination from the body which manifests itself as dry skin and hair.

Biochemical Roles: Silicon is an essential trace mineral (1972). It plays a role in bone and teeth calcification as well as formation of elastin and collagen (it strengthens bones, arteries tendons, stomach lining, hair and skin). It is also found in cornea and sclera (white of the eye) but this role has not been adequately researched. Other tissues, such as liver, kidney and blood, contain very little. Silicon may help heal arteriosclerosis--the narrowing of veins and capillaries due to plaque--and aid in lessening the damage from osteoporosis. Silicon can form long complex molecules in the same manner as carbon. However, chemical bonds involving silicon atoms are stronger than bonds involving carbon atoms. As a result, silicon-containing molecules are relatively stable and structurally strong. There is evidence that some complex molecules in plants and animals are either linked together by silicon or have silicon substituting for one of the carbon atoms at regular intervals or at least inserted periodically in the complex molecules. It may be that silicon is used to provide strength or "architectural" rigidity wherever certain structural molecules are used extensively, such as in bone and organ tissue. Until recently, biologists believed that silicon was not essential to any other animals. Since several components of collagen (structural polysaccharides such as chondroitin sulfate and hyaluronic acid) contain 300 to 550 parts per million of bound silicon, this silicon may be cross-linking these molecules, increasing their size and stability. The silicon content of arteries declines by more than half over the first forty years of age or in arteriosclerosis, even though the chondroitin sulfate content does not.
Several studies have shown that wherever arteriosclerotic plaque is found in human arteries, there is a considerable decrease in silicon in that artery in comparison to arteries without plaque. One study of persons over sixty years of age determined the difference. There was fourteen times as much silicon in disease-free arteries as in arteriosclerotic arteries. There was also significant difference in the amount of silicon in the blood. Heart disease deaths are lowest in the regions of England and Finland where silicon concentrations in drinking water are highest.

Possible Causes: Most often high silicon levels are due to exogenous sources (dust, sand, etc) ie contamination of the hair. In rare cases excessive supplementation may cause high Silicon levels. It is extremely rare for excessive levels to be associated with dietary intake.

Signs & Symptoms: Two major types of renal toxicity are observed: obstructive (urolithiasis) and toxic (nephropathy). The formation of silica urolithiasis is augmented by increased urinary protein, electrolytes, pH, possible elevated urinary phosphate and lowered electrolytes. Increased levels of Silicon have been found in the brains of people with Alzheimer's disease.

Supplementation: High levels of Molybdenum, and Magnesium inhibit Silicon absorption.

RDA's Foods and Other Info: There is no RDA but optimal intake has been suggested to be 20. - 50. mg. Dietary sources include cabbage, milk, whole grains (oatmeal, brown rice), beets, alfalfa, the herb horsetail (Equisetaceae), peppers, soybeans, turnips, raisins, green beans, brown rice, soy meal, pectin (from citrus fruit), kelp, onion, lettuce, curry powder and hard water. The silicon content of plant fibres is not related to their cellulose content, and in fact, cellulose contains very little silicon. Starch and glycogen also contain practically no silicon, and refined flour and soybean products are also low in this element. Bran is not a reliable source of silicon and "high fibre" bread made with cellulose contains practically none Meat, fish and dairy products are poor sources. Boron, calcium, magnesium, manganese, and potassium aid in the efficient utilization of silicon. The estimated average human daily intake of silicon from food is approximately 21 to 46 milligrams.

BORON (B)

B High: Boron is relatively non-toxic. It's biochemical roles are still largely unknown. Boron helps to prevent postmenopausal osteoporosis and build muscle. A study conducted by the U.S. Department of Agriculture indicated that within eight days of supplementing their daily diet with 3 milligrams of boron, a test group of postmenopausal women lost 40 percent less calcium, one-third less magnesium, and slightly less phosphorus through their urine than they had before beginning boron supplementation. Action is not warranted based on the observation of low Boron levels alone.
Action is not warranted based on the observation of moderately high Boron levels alone.

Relevance of Hair Levels: Boron is commonly found in hair. The effect of high concentrations of Boron in hair and nutritional status has not been well studied.

Biochemical Roles: Boron is found in bones and other structural components and may play a major role in maintaining bone density and preventing osteoporosis. It has been shown to affect bone and teeth density and equilibrium. It may activate vitamin D which increases Calcium (and probably Magnesium) absorption from intestines and reduces excretion via kidneys. It may also help to maintain testosterone and estrogen levels and enhance the development of muscle mass during progressive resistance exercise. It was established as essential in 1990. Boron appears to reduce body calcium loss by increasing the beneficial effects of estrogen on bone health thus is useful in the prevention and treatment of osteoporosis and arthritis. It may also play a role in joint health. Boron supplementation has been used in he treatment of osteoarthritis in Germany since the mid 1970s. Boron also seems to play a role in the body's ability to generate energy, especially during exercise and may activate certain hormones. In postmenopausal women, adequate boron raised blood levels of both estrogen and testosterone. It also might help in converting vitamin D to its active form. Bodybuilders who have used boron to increase testosterone levels have been disappointed. Large amounts of this mineral does not seem to affect hormone levels in people who are already getting adequate levels. It has been reported to enhance brain function, promote alertness, and play a role in how the body utilizes energy from fats and sugars. It was established as essential in 1990.

Possible Causes: High dietary or supplemental intake. Contamination is possible as Boron is found in soap, cement, glass and many industrial chemicals.

Signs & Symptoms: There are no documented symptoms associated with normal dietary or supplemental intake. Problems such as nausea, vomiting, and diarrhoea occur only at extremely high doses (greater than 500 milligrams per day).

Supplementation: There is no established protocol (or need) for reducing body burden.

RDA's Foods and Other Info: RDA's range between 1.5 and 3. mg / day depending on age and sex. Some diets contain as much as 20 mg per day. Dietary sources include apples, carrots, grapes, pears, avocado, banana, carrot, soy meal, wine, seafood, dark green leafy vegetables, nuts whole grains and legumes. However, the level of boron in these foods depends on adequate levels of boron in the soil. It is estimated that the average boron intake is somewhere between 1.7 and 7 milligrams per day. Because the minimum amount required by humans to maintain health has not been determined, no one knows whether these amounts are optimal. Research suggests that they are not. Interestingly, a diet rich in fruits and vegetables offers significant protection against osteoporosis and osteoarthritis--two conditions in which boron appears to offer benefit. Typically, the standard diet is severely deficient in these boron-rich food.

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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 homeostatis.

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.

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 hyperactivity). Symptom assessment should be used to verify this.

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).

Supplementation: 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)

Na High: The interpretation of high sodium levels in hair is difficult. Only limited published scientific studies have been performed on the clinical significance of hair sodium and potassium, and for that reason these elements are considered to be of only questionable clinic significance at this time. Hair levels of sodium and potassium are considered to be possibly significant in the presence of cystic fibrosis, celiac disease, and hyperparathyroidism.

Relevance of Hair Levels: Hair concentrations of Sodium correlate loosely with nutritional status and blood concentrations may be necessary to confirm electrolyte imbalance. However, blood levels of sodium reflect neither total body content nor clinical status. If low hair Sodium is accompanied by symptoms of water retention then the water-to-sodium intake ratio may need adjusting by increasing water intake. Sodium / Potassium (about 2/1) ratios are more informative than hair concentration levels. caution in reviewing results from different laboratories

as these electrolites are water soluible and the laboratory analytical process of washing or not washing the hair will generate substantial differences in reported concentrations. The ratios should remain revelant.

Biochemical Roles: The adult body averages a total content of over 100. grams of sodium and it's levels are closely regulated by the endocrine system. The body maintains the sodium concentration in the extra cellular fluid by adjusting the water content. Excess sodium retention increases the fluid volume (oedema) and low sodium leads to less fluid and relative dehydration. A surprising one-third of the Sodium is in bone. About 10. percent gets into cell interiors and the remaining 57. percent or so is in the fluid immediately surrounding the cells, where it is the major cation. The role of sodium in the extra cellular fluid is maintaining osmotic equilibrium (the proper difference in ions dissolved in the fluids inside and outside the cell) and extra cellular fluid volume. Sodium is also involved in nerve impulse transmission, muscle tone and nutrient transport. All of these functions are interrelated with potassium. It helps to maintain acid-base balance, is essential to muscle contraction and nerve conduction. Sodium is crucial for water balance in the body and good muscle function.

It is often viewed in relation to hypertension and high-salt diets but evidence suggests that this is true only in cases where water intake is inadequate and kidney function is impaired. High blood pressure is a sign of several diseases. It is not one disease with one cause or one cure. Some people develop the high blood pressure as a symptom that their potassium-sodium ratio is out of balance. There is an inherited trait that makes the blood pressure in a portion of the population sensitive to dietary sodium. These persons often have increased blood pressure when sugar and salt are both high in their diets. Low renin* activity may be as important as dietary potassium-sodium ratio. Blindly following a low-salt diet, may not be as effective as a diet with better balance in the potassium-sodium ratio. A high fat intake may also add to blood pressure elevations in some individuals.
***Renin:** a proteolytic enzyme secreted by the kidneys which catalyses the formation of aldosterone,a kidney enzyme that raises blood pressure by restriction of the blood vessels)

When sodium intake is high, the level of adrenal cortex hormone, aldosterone, decreases in the blood, and the kidney is thus influenced to excrete more sodium in the urine. When the dietary intake of sodium is small, the aldosterone level increases, and urinary excretion of sodium decreases to essentially zero. Kidney patients have trouble maintaining proper sodium levels.

Possible Causes: High concentrations of sodium usually occur with high concentrations of potassium. If only sodium is elevated, then excessive perspiration, salt water swimming or excessive salt intake in food 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. Elevated sodium is related to hypertension and is sometimes associated with high levels of toxic elements. Not all hypertension is responsive to salt levels but some people ('Salt-responders') benefit from a reduction of salt in the diet. Some diuretics have been found to increase hair sodium levels considerably.

Signs & Symptoms: Water loss or insufficient intake, combined with high Sodium intake is the usual cause of general dehydration and this net sodium excess can result in symptoms like intense thirst, fatigue and muscle weakness. These are usually acute rather than chronic.

Supplementation: Balancing nutrients are: Vitamins B1, B3, B5, B6, B12, D, E, Potassium, Selenium, Calcium, Copper, Phosphorus, Iron. Increasing water intake may result in normalization of Sodium levels. If endocrine problems are suspected they must be addressed before Sodium levels will return to normal. 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's Foods and Other Info: RDA is between 2. and 3. grams. Dietary levels are usually high and normal kidney function eliminates excess via urine so as to maintain a constant Sodium-to-water ratio. It is important to maintain adequate water intake to support the kidneys. Indeed, to reduce water retention it is usually necessary to INCREASE water intake. Natural foods tend to be low in sodium and high in potassium, but processed foods are the opposite. Salt is normally added to enhance flavour by the food processing company, and potassium is often leached out by the water during processing. Typical diets supply between 2300. and 6900. mg sodium daily but some sub-populations consume much more. Among some populations, adult humans are known to live normally for long periods with salt intakes exceeding 40. grams! North American diets usually supply two to five times the recommended limits per day. Virtually all sodium ingest in the diet is absorbed.

Individual foods that are high in sodium include salt, bread, crackers, liquid milk (both cow and goat), celery, pasteurized cheeses, olives, bacon, peanut butter, pickles, pudding mixes, french fried potatoes, soy sauce, natural yogurt, eggs, honey, beef, pork, bacon, canned ham, chicken, liver, kidney, haddock (fresh), herring, kipper, butter (salted and unsalted), margarine, most animal foods, and MSG (the flavour enhancer monosodium glutamate) and potato chips. Other unsuspected sources of sodium are softened water, red wines, some food additives and some medicines. Most processed foods contain very high levels.

ENDOCRINE EVALUATION

Electrolyte levels suggest normal adrenal and hyper thyroid function. Symptom analysis and other tests should be used to confirm this finding.

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)

Copper is in normal range.

IRON (Fe)

Iron is in normal range.

SELENIUM (Se)

Selenium is in normal range.

CHROMIUM (Cr)

Chromium is in normal range.

MANGANESE (Mn)

Manganese is in normal range.

NICKEL (Ni)

Ni Low: At elevated levels nickel may be considered a toxic element but evidence exists to suggest that it is a required element at low concentrations. Nickel has long been suspected as having an essential role in human health, but the research has been confusing. Early studies suggesting that low-nickel diets resulted in reduced growth rate of laboratory animals were flawed because the control diets used also produced sub-optimal growth.

Relevance of Hair Levels: Hair concentration is an approximate indicator of body load. This observation of low hair nickel concentration is not uncommon but the nutritional significance of this observation is not yet known.

Biochemical Roles: The biological role of nickel has not been well documented but it may play a role in the metabolism or in the structure of cell membranes. Evidence suggests that nickel may also have a role in RNA, DNA and/or protein structure or function. Significant amounts of nickel are present in RNA and DNA. It is suggested that nickel may have some role in prolactin regulation via an influence on hormonal control. Nickel may play a role in the metabolism of glucose and hormonal functions. It also helps to activate certain important enzymes, such as trypsin and arginase.

Possible Causes: Insufficient intake or malabsorption are the main reasons for low Nickel levels.

Signs & Symptoms : Deficiencies may harm the liver and other organs. A Nickel deficiency may affect iron and zinc metabolism.

Supplementation: Supplementation with Nickel is not recommended at this time.

RDA's Foods and Other Info: Nickel deficiency is not known to be a dietary problem. Grains and vegetables are comparatively rich in nickel, whereas meats, eggs, milk, butter and white bread are very low in nickel. RDA has not been established. The dietary requirement, if nickel is essential, may be somewhere near 50. to 75. micrograms per day.

VANADIUM (V)

V Low: Vanadium was declared an essential nutrient in 1971 but its role in human nutrition has not been firmly established. It has been suggested that a deficiency may increase one's susceptibility to cancer and heart disease.

Relevance of Hair Levels: Hair is an approximate indicator. Vanadium is usually found at very low concentrations in hair. The significance of lower than normal hair values has not been established. The vanadium content in hair correlates with tissue vanadium content in toxic states. Vanadium disappears from the blood and is involved in skeletal tissue mineralization. Radioactive vanadium, used as a tracer, disappears from blood after twenty days.

Biochemical Roles: The total amount of vanadium in the average adult's body may be in the range of 17. to 43. milligrams.
Vanadium is essential for growth and is involved in fat metabolism. A vanadium deficiency results in increased blood cholesterol and triglycerides levels. A reduction of blood and tissue cholesterol may be possible in some people by establishing normal Vanadium and Chromium levels. The altered levels of blood and tissue cholesterol have been related to Vanadium inhibition of the microsomal enzyme system known as squalene synthetase, and to the vanadium stimulation of the enzyme, acetoacetyl-CoA deacylase in liver mitochondria. This enzyme is important to the conversion of fat into coenzyme A.
Vanadium may play a role in thyroid function and may affect glucose metabolism by exerting an insulin-like (lowers blood levels of glucose) effect. It facilitates glycogen formation and may inhibit the formation and deposition of cholesterol in blood vessels and the liver Vanadium may have anti-diabetic and weight-reducing functions. Vanadium deficiency may retard bone and tooth formation. There is abnormal bone growth in vanadium deficiency, and when radioactive Vanadium is used to race the travel of vanadium in the bodies of laboratory animals, the highest uptake of vanadium is found to be in tooth dentine and bone. The zones of mineralization show the greatest vanadium uptake. It may play a role in osteoblast / osteoclast chemistry.
It is also believed that vanadium functions as an oxidation-reduction catalyst.

Possible Causes: Low intake & malabsorption are both common. Tobacco and alcohol use decreases the uptake of vanadium.

Signs & Symptoms: The effects of chronic Vanadium deficiency has not yet been established. Although vanadium may function in hormone, cholesterol, and blood sugar metabolism, no specific deficiency signs or symptoms in humans have been reported. Some researchers speculate that a vanadium deficiency may contribute to elevated cholesterol levels and faulty blood sugar control manifesting as either diabetes, hypoglycemia, chronic fatigue or fibromyalgia. It has also been speculated that Vanadium deficiencies may be involved in some manner with bone pathologies.

Supplementation: Supplementation should not exceed 80 ug (micrograms) per day. Levels higher than 250. ugs (micrograms) may be toxic.

RDA's Foods and Other Info: RDA has not been established. The human requirement for vanadium is not known, and dietary intake data are meagre. Typical intakes range widely from less than 2. micrograms to over 1. milligram. Foods contain very low concentrations of Vanadium. Foods that contain some Vanadium are: black pepper, dill, parsley, mushrooms, whole grains, corn, oats, tomatoes, parsley, carrots, olive oil, sunflower seeds, apples, beets, shellfish, nuts, fibre rich foods and vegetable oils. Vanadium is not easily absorbed. Athletes and people who expend large amounts of energy may require more of this trace mineral than sedentary people.
Diets consisting exclusively of milk, meat and certain vegetables could contain less than one-tenth milligram. The Vanadium content of food varies over a very wide range depending on the vanadium content of the soil.

MOLYBDENUM (Mo)

Molybdenum is in normal range.

COBALT (Co)

Co Low: Cobalt is found in the body as part of Vitamin B12.

Relevance of Hair Levels: The significance of low Cobalt levels in hair has not yet been established.

Biochemical Roles: Vitamin B12 (cobalamin) is the only known biological role of Cobalt. Cobalamin (B12) is required for all cells and is particularly important in bone marrow, nervous system, and GI tract. It interacts with iodine to promote normal thyroid function. It is found mainly in the liver where it activates many enzymes. It is excreted in the bile.

Possible Causes: Insufficient intake and/or malabsorption.

Signs & Symptoms: Deficiency or inability to absorb B12 causes pernicious anaemia which exhibits as fatigue and permanent nerve damage.

Supplementation: The conversion of inorganic Cobalt to vitamin B12 does not occur and supplementation of Cobalt intake with other than this vitamin is not recommended as many forms of soluble Cobalt are toxic. Vegans are particularly prone to B12 deficiency.

RDA's Foods and Other Info: RDA is 1 ug (microgram) as B12. The main source of vitamin B12 is red meats, cheese, brewers yeast, and vitamin B12 supplementation (which is difficult to absorb and requires healthy levels of stomach acid).
No estimated Safe and Adequate Daily Intake has been set for cobalt. You must get the amount you need from preformed vitamin B12 (not elemental Cobalt).

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)

Ca / P High: An ideal ratio is about 2.5//1. High Ca/P ratios are associated with deficiencies or malabsorption of omega-3 and omega-6 essential fatty acids. Increased levels of inflammation may be due to low levels of prostaglandin which is in turn due to low levels of EFA. Ratios over 3 would reflect exhaustive stage of stress.

Calcium / Potassium (Ca / K)

Ca/K Low: The ratio reflects thyroid function: ideal ratio of 4/1. Calcium slows thyroid function while Potassium would speed speed it up- **Fast Oxidizer** would have high potassium and need to consume calories as they burn them rapidly. Tend to be low in Zinc, Copper and Manganese. Diet should avoid fruits,starch and include fat and oils. Very low levels may indicate Thyroid disfunction. Symptoms of an overactive thyroid would be excessive sweating, hyperactivity, irritability, agressiveness, muscle tightness, cramps, nervousness, extroverted, happy. Manganese or selenium imbalances may cause ratio issues.

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)

Zinc / Copper (Zn/Cu) ratio is in normal range.

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)

Selenium / Mercury (Se / Hg)

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

Zinc / Mercury (Zn/Hg)

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)

Silver (Ag) is in normal range.

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)

Germanium (Ge) is in normal range.

Zirconium (Zr)

Zr High: Zirconium levels in hair have not been studied well enough to establish whether they correlate with body burden.

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 use as the sole means for diagnosis 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.

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