

Hair Analysis Testing Information

ALUMINUM

Source of Aluminum Toxicity

- Beverages from aluminum cans (soda pop and beer)
- Food cooked in aluminum cookware
- Use of aluminum-containing antacids
- Use of anti-perspirants
- Drinking water (aluminum is frequently added to municipal water)
- Baking powders
- Drying agents in salt and other products
- Processed cheese
- Bleached flour
- Fluoridated water increases leeching of aluminum from aluminum pots and pans

Today children are often born with elevated aluminum that is passed from mother to fetus through the placenta.

Detection of Aluminum Toxicity

There is debate whether blood testing for aluminum has much value. Blood levels definitely do not indicate total body load of aluminum. Hair aluminum levels appear to correlate well with bone levels of aluminum. Several hair tests may be needed before aluminum is revealed on the test. This is because the aluminum may be tightly bound within body tissues and several months on a nutrition program may be required to mobilize the aluminum.

How Aluminum Affects Health

Nervous System: In animal studies, aluminum blocks the action potential or electrical discharge of nerve cells, reducing nervous system activity. Aluminum also inhibits important enzymes in the brain (Na-K-ATPase and hexo-kinase). Aluminum may also inhibit uptake of important chemicals by nerve cells (dopamine, norepinephrine and 5-hydroxytryptamine).

Behavioral Effects: Dementia resulting from kidney dialysis related to aluminum toxicity causes memory loss, loss of coordination, confusion and disorientation.

Digestive System: Aluminum reduces intestinal activity and by doing so can cause colic.

Possible Conditions Associated With Aluminum Toxicity

Early symptoms of aluminum toxicity include: flatulence, headaches, colic, dryness of skin and mucous membranes, tendency for colds, burning pain in head relieved by food, heartburn and an aversion to meat. Later symptoms include paralytic conditions, loss of memory and mental confusion.

Other Possible Conditions Associated With Aluminum Toxicity

Alzheimer's disease	Hypoparathyroidism
Amyotrophic Lateral Sclerosis	Kidney dysfunction
Anemia	Liver dysfunction
Hemolysis, Leukocytosis, Porphyria	Neuromuscular disorders
Colitis	Osteomalacia
Dental cavities	Parkinson's disease
Dementia dialactica	Peptic ulcer

Hair Analysis Testing Information

ARSENIC

Sources of Arsenic

- Organic arsenic (arsenate) is found in a variety of foods
- Inorganic arsenate or arsenite: pesticides, beer, table salt, pain, cosmetics, pigments, rat poison, glass and mirror manufacture, fungicides, wood preservatives

Roles in the Body

Several laboratories believe that arsenic is an essential element in small quantities. Its functions are not clear, but may have to do with growth and blood formation.

Symptoms Associated with Arsenic Deficiency

Laboratory rats deprived of arsenic showed slower growth, iron-laden spleens and rough hair. Their offspring had fragile red blood cells.

Symptoms Associated with Arsenic Excess

- Enzyme inhibitor
- Interferes with uptake of folic acid
- Inhibition of sulfhydryl enzyme systems

Chronic Symptoms:

abdominal pain	hair loss	pallor
abnormal ECG	headache	peripheral neuritis
anorexia	herpes	sore throat
dermatitis	impaired healing	stomatitis
diarrhea	jaundice	stupor
edema	keratosis	vasodilation
fever	kidney damage	vertigo
fluid loss	liver dysfunction	vitaligo
goiter	muscle spasm	weakness

Antagonists

Iodine, selenium

Hair Analysis Notes

Arsenite accumulates in the hair tissue and hair analysis is considered a valuable means of detecting arsenic toxicity

Hair Analysis Testing Information

BORON

Sources of Boron

Leafy vegetables, fruits, nuts, legumes, wine, cider and beer

Functions in the Body

- Increases production of estrogen and testosterone
- Helps prevent osteoporosis and post-menopausal symptoms
- May be necessary for growth (animal experiments)

Symptoms Associated with a Boron Deficiency

Osteoporosis, hot flashes and vaginal dryness in post-menopausal women.

Symptoms Associated with a Boron Excess

Low toxicity. In animals, excessive intake affects calcium metabolism and may cause osteoporosis and increased urinary excretion of riboflavin.

Hair Analysis Notes

Significance in the hair is unknown

Hair Analysis Testing Information

CADMIUM

Sources of Cadmium Toxicity

- food grown on cadmium contaminated soil – sewage sludge, fertilizers and irrigation water can contaminate the soil
- large ocean fish – tuna, cod, haddock
- refined and processed foods
- processed meats, cola drinks and instant coffee
- cigarette smoke
- contaminated drinking water
- occupational exposure – battery manufacture, semiconductors, dental materials
- solder used in food cans
- motor oil and exhaust fumes from cars
- artists paints
- air pollution – incineration of rubber tires, plastic and paints

Children today are commonly born with cadmium toxicity passed from mother to child via the placenta.

Detection of Cadmium Toxicity

“...Cadmium data from blood have little diagnostic value” (Cranston & Passwater, 1983). This is because cadmium is rapidly removed from the blood soon after it is ingested.

Blood challenge tests can detect cadmium in the blood and arteries.

Cadmium levels in hair show good correlation with cadmium levels in the kidneys. Often, however, several months of nutritional therapy and several hair tests are required before cadmium is revealed in the hair.

How Cadmium Affects Health

Energy: cadmium causes strong inhibition of essential enzymes in the Krebs energy cycle.

Nervous system: cadmium inhibits release of acetylcholine and activates cholinesterase. This results in a tendency for hyperactivity of the nervous system. Cadmium also directly damages nerve cells.

Bones and Joints: cadmium alters calcium and phosphorus metabolism, thus contributing to arthritis, osteoporosis and neuromuscular diseases.

Cardiovascular System: cadmium replaces zinc in the arteries, contributing to brittle, inflexible arteries.

Digestive System: cadmium interferes with production of digestive enzymes that require zinc.

Male Reproductive System: prostate problems and impotence can result from cadmium-induced zinc deficiency

Endocrine System: Zinc is required for growth and insulin release. Cadmium can contribute to failure to thrive, delayed growth development and diabetes.

Excretory System: cadmium accumulates in the kidneys, resulting in high blood pressure and kidney disease.

Dental: alterations in calcium and Vitamin D activity, caused by cadmium toxicity, can result in cavities and tooth deformities.

Psychological: cadmium toxicity is associated with learning disorders and hyperactivity. This may be due to zinc deficiency, or to inhibition of acetylcholine release in the brain.

Hair Analysis Testing Information

CADMIUM (Continued)

Possible Conditions Associated with Cadmium Toxicity

alopecia (hair loss)	failure to thrive syndrome
anemia	fertility, decreased
atherosclerosis	hyperlipidemia (high levels of fat in the blood)
arteriosclerosis	hyperactivity in children
arthritis, osteo	hypertension
arthritis, rheumatoid	hypoglycemia
bone repair, inhibited	inflammation
cancer	lung disease
cardiovascular disease	migraine headaches
cerebral hemorrhage	osteoporosis
cholesterol, elevated	renal (kidney) disease
cirrhosis of the liver	schizophrenia
diabetes	sex drive, reduced
emphysema	strokes
enlarged heart	vascular disease

Hair Analysis Testing Information

CALCIUM

Sources of Calcium

Seafood – sardines, caviar, smelt

Animal products – egg yolks

Nuts/seeds – almonds, sesame seeds, filberts

Vegetables – kale, collards, mustard greens, turnip greens

Dairy – cheeses, milk

Miscellaneous – molasses, kelp, brewer's yeast, torula yeast

Roles in the Body

About 99% of our calcium is found in bone structures. However, calcium is essential for four other critical roles:

- Cell Membrane Regulation – affecting cell permeability, muscle contraction and nerve impulse conduction.
- Body Fluid Regulation – affecting blood clotting, acidity and alkalinity
- Regulation of cell division
- Regulation of hormone secretion – insulin

Functions of Calcium

Circulatory – excites the heart, constricts small blood vessels

Excretory – inhibits water loss

Digestive – in excess, is constipating

Nervous – slows nerve impulse transmission

Reproductive – required for normal cell division

Endocrine – inhibits release of thyroid releasing and other pituitary hormones

Blood – stimulates blood formation and is required for blood clotting

Muscular – reduces muscular irritability and contractibility

Skeletal – main component of bone

Metabolic – required for phosphorous metabolism and energy production in the Krebs cycle

Detoxification – inhibits uptake of lead, antagonizes cadmium

Cellular – decreases permeability of cells to sodium and potassium ions

Symptoms Associated with a Calcium Deficiency

alarm or fight-flight reaction	irritability
anxiety	muscle cramps and spasms
bruising	nervousness
“fast” oxidation	osteoporosis
high blood pressure	tooth decay
insomnia	

Symptoms Associated with a Calcium Excess

apathy	gall stones
arthritis	hardening of arteries
constipation	kidney stones
depression, mental	“slow” oxidation
fatigue	withdrawal, social

Hair Analysis Testing Information

CALCIUM (Continued)

Nutrients that are Synergistic with Calcium

Absorption – vitamin A and D, stomach acidity, protein in diet

Utilization – magnesium, copper, vitamin C

Antagonistic Nutrients

Absorption – fluoride, low stomach acidity, low protein in diet, phosphorous in excess

Utilization – lead, cadmium, sodium, potassium, high protein diet increases calcium loss in urine

Hair Analysis Notes

High Hair Calcium:

- usually indicates that calcium is leaving the bones and accumulating in the soft tissues of the body
- high calcium is associated with a slow oxidation rate
- good indicator of hidden copper toxicity
- high calcium on a retest often means the body is eliminating excess calcium

Low Hair Calcium:

- a low calcium level usually means calcium is being lost in the urine
- associated with fast oxidation rate – alarm stage of stress
- often associated with copper deficiency

Reasons for Calcium Supplementation

- to slow the oxidation rate
- to help detoxify lead and cadmium
- to balance key mineral ratios

Hair Analysis Testing Information

CHROMIUM

Sources of Chromium

Seafood – oysters

Meats – calves' liver, egg yolk

Nuts/seeds – peanuts

Fruit – grape juice

Dairy – American cheese

Grains – wheat and wheat germ

Miscellaneous – brewer's yeast, black pepper, molasses

Roles in the Body

- Glucose tolerance factor – chromium is involved in maintaining blood sugar levels and energy levels.
- Cholesterol regulation
- Other possible roles involved in the synthesis of DNA

Functions of Chromium

Circulatory – serum cholesterol regulation

Digestive – sugar and carbohydrate utilization (via insulin)

Nervous – maintenance of nervous system by regulation of blood sugar

Eyes – corneal clarity

Muscular – supplies energy for muscular contraction

Skeletal – essential component of bones and hair

Protective – immune system (via insulin)

Metabolic – fat, protein and carbohydrate metabolism regulation

Symptoms Associated with a Chromium Deficiency

Atherosclerosis	elevated serum cholesterol levels
Depressed growth	fatigue
Diabetes	hypoglycemia

Symptoms Associated with a Chromium Excess

asthma	kidney damages
allergies	sinusitis
calcium deficiency	ulcers
causes an iron deficiency	vomiting
diarrhea	

Synergetic Nutrients

Insulin, glucose, magnesium, vitamin B6, zinc, manganese oxalates, salicylates

Antagonistic Nutrients

Absorption – iron, manganese, zinc, vanadium, phytates

Metabolic – glucagon

Hair Analysis Testing Information

CHROMIUM (continued)

Hair Analysis Notes

High Hair Chromium:

- A high chromium level is often indicative of a loss of chromium through the hair and is frequently caused by an iron toxicity or another mineral imbalance problem.

Low Hair Chromium:

- Supplementing with chromium when the chromium reading is low, is frequently helpful in correcting symptoms of fatigue, or sugar and carbohydrate intolerance.
- Excessive iron intake is a frequent cause of both high and low chromium levels.

Hair Analysis Testing Information

COBALT

Sources of Cobalt

Meats (as vitamin B12)

Roles in the Body

Needed for the formation of vitamin B12 – blood formation, nervous system

Symptoms Associated with a Cobalt Deficiency

Pernicious anemia (deficiency of vitamin B12)

Symptoms Associated with a Cobalt Excess

Cardiomyopathy, death

Hair Analysis Testing Information

COPPER

Sources of Copper

Seafood – oysters, crabs, bluefish, perch, lobster

Meats – calf, duck, lamb, pork, beef liver and kidneys

Nuts/seeds – almonds, pecans, walnuts, filberts, brazil nuts, sesame, sunflower, pistachio

Vegetables – soybeans

Grains – wheat germ and bran

Miscellaneous – yeast, gelatin, bone meal, corn oil, margarine, mushrooms, chocolate

Other sources – copper water pipes, copper sulfate added to drinking water, copper compounds used in swimming pools, mineral supplements (especially prenatal vitamins), copper cookware and tea kettles, birth control pills, copper intrauterine devices, vegetarian diets, stress, exhaustion of the adrenal glands

Many children are born today with excessive copper levels passed to them from their mothers in utero.

Roles in the Body

- Energy production
- Female reproductive system
- Blood formation

Functions of Copper

Circulatory – structure of blood vessels, aorta and heart muscle

Blood – formation of hemoglobin

Nervous – maintenance of the myelin sheath on nerves

Reproductive – essential for fertility, menstrual cycle

Endocrine – synthesis of stimulatory neurotransmitters

Muscular/skeletal – bone and connective tissue structure

Immune system – necessary for the immune system

Integumentary – needed for skin, hair, nails and pigments

Energy – energy production (the electron transport system)

Symptoms Associated with a Copper Deficiency

anemia	hair loss
atherosclerosis	impaired collagen formation
demyelination of nerves	loss of hair color
diarrhea	low hormone production
edema	osteoporosis
fatigue	

Symptoms Associated with a Copper Excess

acne	fatigue	mind racing
adrenal insufficiency	fears	mood swings
allergies	fractures, bone	multiple sclerosis
alopecia	headaches (migraine)	myocardial infarction
anemia	hemorrhages	nausea
anorexia	heart disease	pancreatic dysfunction
anxiety	hyperactivity	premenstrual tension
arthritis	hypertension	schizophrenia

Hair Analysis Testing Information

COPPER (Continued)

autism	hyperthyroidism	sexual inadequacy
cholesterol, elevated	hypochlorhydria	spaciness
cancer	hypoglycemia	strokes
cystic fibrosis	infections	tooth decay
depression, mental	inflammation	urinary tract infections
diabetes	insomnia	vitamin deficiencies
estrogen (imbalance)		

Synergetic Nutrients

Absorption – proteins

Antagonistic Nutrients

Absorption – zinc, manganese, iron, calcium, molybdenum, sulfur, mercury, cadmium, vitamin C

Metabolic – zinc, vitamin C, vitamin B₆, sulfur, molybdenum, manganese, iron

Hair Analysis Notes

- Bio-unavailable copper: often copper status can be tricky to assess. Copper may be present, but unavailable for use in the body. This occurs any time adrenal gland activity is low.
- Copper and Oxidation Type: Fast oxidizers generally are deficient in copper, while slow oxidizers usually have either high copper or bio-unavailable copper.
- Hidden Copper Toxicity: Copper is often normal on hair tests, but may actually be locked in body tissues. Test indicators of a hidden copper imbalance are:
 - Calcium level greater than 75 mg%
 - Potassium level less than 3 mg%
 - Sodium/potassium ratio less than 2.2:1
 - Mercury toxicity often indicates a hidden copper toxicity
 - Copper level less than 1.0 mg%
 - Zinc/copper ratio less than 6:1

Reasons for Supplementation with Copper

- To raise a low sodium/potassium ration
- To enhance retention of calcium in tissues

Hair Analysis Testing Information

IRON

Source of Iron

Seafood – clams, oysters

Meats – liver and kidneys, beef, reindeer meat

Nuts/seeds – pistachio, pine nuts, black walnuts, sesame seeds, sunflower seeds, pumpkin seeds

Vegetables – Irish moss, chives, parsley, soybeans

Grains – wheat germ and bran, rice bran

Miscellaneous – red wine, black strap molasses, sorghum syrup, bone meal, yeast

Roles in the Body

- Oxygen transport – iron is the part of the hemoglobin molecule that carries oxygen in the blood
- Cellular energy production – iron is required in the final steps of the production of energy from food
- Removal of harmful free radicals – catalase enzyme requires iron

Symptoms Associated with and Iron Deficiency

anemia	hydrochloric acid deficiency
brittle nails	low blood pressure
decreased resistance	pallor
dizziness	slow oxidation
fatigue	weakness

Symptoms Associated with an Iron Excess

arthritis	high blood pressure
cancer	iron deposits in organs
cirrhosis of the liver	liver disease
diabetes	myasthenia gravis
emotional problems	schizophrenia

Synergetic Nutrients

Absorption – acid foods, animal foods, vitamin C, alcohol, glucose and other sugars

Utilization – copper, vitamin B12

Antagonistic Nutrients

Absorption – phytates, phosphate, egg protein, manganese, zinc, nickel, chromium, copper, calcium, magnesium, cadmium, vegetarian diets

Hair Analysis Notes

Iron is referred to as the strength mineral

High Hair Iron:

- Often associated with feelings of anger and hostility
- More often seen in fast oxidation
- Often associated with high aluminum levels
- Can be due to an iron loss due to destruction of body cells

Hair Analysis Testing Information

IRON (Continued)

- Iron toxicity can be due to iron cookware or excessive iron in drinking water

Low Hair Iron:

- Most often associated with a slow oxidation rate
- Common to see iron levels around 1.0%
- Low hair iron does not necessarily indicate anemia
- Low iron often seen with symptoms of fatigue
- Taking iron tablets will not necessarily raise iron levels

Reasons for Iron Supplementation

- To raise low sodium levels
- To increase a low oxidation rate
- To lower elevated manganese levels

Hair Analysis Testing Information

LEAD

Sources of Lead Toxicity

ceramic glazes	lead water pipes
cigarette smoke	leaded gasoline
colored ink	manufacture of batteries
food cans soldered with lead	mine smelting industries
Grecian formula and Youth Hair	pesticide residues
hair dyes	water contaminated with lead from industrial waste
lead-based paint	

Children can also be born with elevated lead, passed through the placenta from their mothers.

Diets deficient in calcium, magnesium, or iron increase lead absorption.

Detection of Lead Toxicity

- Blood lead testing is not accurate in detecting chronic lead toxicity. Within 30 days of exposure, most lead is removed from the blood and stored in body tissues.
- Blood challenge tests can detect a certain amount of lead poisoning.
- Hair testing has been shown by the Environmental Protection Agency to be a good method of testing for lead poisoning.
- Several hair tests may be necessary before elevated lead levels are revealed.

How Lead Affects the Body

Blood – inhibits enzymes associated with hemoglobin synthesis and increases the rate of destruction of red blood cells. End result is fatigue.

Bones – lead is incorporated into bone in preference to calcium.

Brain – can inhibit copper-dependent enzymes needed for neurotransmitters (dopamine, epinephrine, norepinephrine). End result is hyperactivity.

Energy – inhibits copper and iron-dependent enzymes in the Krebs cycle required for energy production. End result is fatigue.

Kidneys – lead can raise uric acid levels and impair kidney function. End result is gout.

Minerals – lead displaces and can cause deficiency or bio-unavailability of calcium, zinc, manganese, copper and iron.

Thyroid Gland – lead interferes with iodine uptake by the thyroid and can inactivate thyroxin, the thyroid hormone.

Hair Analysis Testing Information

LEAD (Continued)

POSSIBLE CONDITIONS ASSOCIATED WITH LEAD TOXICITY

Musculo-Skeletal System

arthritis, osteo
arthritis, rheumatoid
back pain, low
gout
rickets

Nervous System

brain function, abnormal
blindness
convulsions
deafness
dyslexia
encephalitis
encephalopathy
epilepsy
fatigue
insomnia
multiple sclerosis
muscular dystrophy
Parkinson's disease
vertigo

Cardiovascular System

arteriosclerosis
atherosclerosis
cardiovascular dysfunction

Digestive System

abdominal pain
colic
constipation
indigestion
liver dysfunction
weight loss

Vascular System

anemia

Reproductive System

abortions, spontaneous
impotency
infertility
libido, diminished
menstrual difficulties
sterility
stillbirths

Glandular System

adrenal insufficiency
hypopituitarism
hypothyroidism

Excretory System

nephritis
renal dysfunction

Dental

pyorrhea
tooth decay

Psychological

anxiety
concentration, poor
depression, mental
hallucinations
hyperkinesis
memory impairment
mental retardation
mood swings
nightmares
psychotic behavior
schizophrenia

Hair Analysis Testing Information

LITHIUM

Sources of Lithium

Small amounts are found in a wide variety of foods

Functions of Lithium

- Decreases manic symptoms in manic-depressive patients
- May modulate the conversion of essential fatty acids into prostaglandins
- May stabilize serotonin transmission
- Anti-aggressive action

Symptoms Associated With A Lithium Deficiency

Deficiency is associated with excessive aggressiveness, manic states and depression.

Symptoms Associated With A Lithium Toxicity

Disturbed mineral transport and fluid balance, nausea, vomiting, tremors, thirst, excessive urination, thyroid swelling, weight gain, drowsiness, confusion, disorientation, delirium, skin eruptions, possible kidney damage and even seizures, coma and death.

Indications for Supplementation

Aggressive behavior, manic-depression and some cases of depression.

Hair Analysis Testing Information

MAGNESIUM

Sources of Magnesium

Nuts – almonds, Brazil nuts, cashews

Vegetables – soybeans, parsnips

Grains – buckwheat, wheat bran, wheat germ, other grains

Miscellaneous – chocolate, cocoa, molasses, brewer's yeast, kelp

Roles In The Body

Sixty percent of tissue magnesium is located in the skeleton. The rest is within the cells, where it performs very essential functions.

- Regulation of Cell Membranes – permeability, muscular contraction, nerve impulse conduction and antagonism to calcium.
- Enzyme Activation within the cells – magnesium is essential for energy production and protein synthesis.

Functions of Magnesium

Excretory – prevention of kidney stones

Digestive – laxative

Nervous – maintains nerve conduction

Muscular – prevents tissue calcification, needed for glucose and fat metabolism and for protein synthesis

Detoxification – required for liver activity

Symptoms Associated With A Magnesium Deficiency

anxiety	irritability
fast heart rate	kidney stones
“fast” oxidation rate	muscle cramps, especially after exercising
high blood pressure	muscle spasms
hyperkinetic behavior	seizures
irregular heart beat	tissue calcification

Symptoms Associated with a Magnesium Excess

confusion	lethargy
depression, mental	low blood pressure
diarrhea	muscle weakness
fatigue	slow oxidation rate

Nutrients That Work With Magnesium

- Vitamin D, lactic acid, lactose, high protein diet
- Potassium is a magnesium synergist in many enzyme systems

Antagonistic Nutrients

Absorption – phytates found in grains, fluoride, phosphorus, low-protein diet

Utilization – calcium. Drinking alcohol lowers magnesium levels. Junk food diets are often low in magnesium.

Hair Analysis Testing Information

MAGNESIUM (Continued)

Hair Analysis Notes

High Hair Magnesium:

- Often associated with a SLOW oxidation rate, fatigue and depression.
- A high magnesium level often indicates that magnesium is being lost through the hair, resulting in deficiency symptoms such as anxiety and hyper-irritability.

Low Hair Magnesium:

- Often associated with a FAST oxidation rate, anxiety, irritability and high-strung personality.

Reasons For Magnesium Supplementation

- To prevent calcium build-up in body tissues
- To enhance energy production and raise low sodium levels

Hair Analysis Testing Information

MANGANESE

Sources of Manganese

Meats – snails, egg yolk

Nuts/seeds – sunflower, coconuts, peanuts, pecans, walnuts, chestnuts, hazelnuts, almonds, brazil nuts

Fruits – blueberries, olives, avocados

Vegetables – corn, corn germ, parsley, legumes

Grains – wheat, wheat germ and bran, rice, barley, oats, buckwheat, rye

Miscellaneous – kelp, cloves, tea

Roles In The Body

- Energy Production, essential for
- Glucose tolerance levels, necessary for maintaining
- Tendons and ligaments, maintains integrity of
- Bone development, essential for

Functions Of Manganese

Nervous system – synthesis of neurotransmitters

Reproductive system – fertility

Endocrine system – required for normal adrenal and thyroid gland activity

Skeletal – tendons, ligaments, connective tissue

Metabolic – energy production, glucose tolerance, utilization of fats and carbohydrates

Detoxification – involved in superoxide dismutase

Symptoms Associated With A Manganese Deficiency

allergies	hypoglycemia
diabetes	myasthenia gravis
dizziness	ringing in the ears
fatigue	weakness, muscular
bone fractures or osteoporosis	weak ligaments and tendons

Symptoms Associated With A Manganese Excess

anorexia	neurological symptoms
ataxia	schizophrenia
iron deficiency	

Synergetic Nutrients

zinc, choline, vitamin K

Antagonistic Nutrients

Absorption – calcium, phosphorus, iron, soy protein

Metabolic – copper, magnesium, iron, vanadium

Hair Analysis Testing Information

MANGANESE (Continued)

Hair Analysis Notes

Manganese is called the maternal mineral because manganese-deficient animals cease to care for their young.

High Hair Manganese:

- May be due to manganese toxicity derived from drinking water containing excessively high levels of manganese.

Low Hair Manganese:

- Low hair manganese levels are extremely common. However, if the manganese level is below .03 mg% it is considered very low.
- Low manganese usually correlates with slow oxidation and low energy levels.

Reasons For Manganese Supplementation

- To raise low sodium levels
- To lower excessive iron, copper or other toxic metal levels
- To correct a low sodium/potassium ratio

Hair Analysis Testing Information

MERCURY

Sources of Mercury Toxicity

- Dental amalgam (silver fillings)
- Tuna fish and swordfish
- Contaminated drinking water
- Seeds and vegetables treated with mercurial fungicides
- Medications – diuretics, Mercurochrome, Merthiolate, Preparation H, contact lens solution
- Occupational exposure – felt, algicides, floor waxes, adhesives, fabric softeners, manufacture of paper, production of chlorine
- Children can be born with mercury toxicity that is passed through the placenta from their mothers. Mercury can also be passed to children in breast milk.

Detection of Mercury Toxicity

Both blood and hair have been used to detect mercury poisoning. In one study, hair levels generally correlated with blood levels. Hair levels are about 300 times higher than blood levels. Copper toxicity and zinc deficiency are often associated with mercury toxicity.

How Mercury Affects Health

Energy – mercury compounds inhibit the enzyme ATPase, which impairs energy production in all body cells.

Nervous system – degeneration of nerve fibers occurs, particularly the peripheral sensory nerve fibers. In addition to sensory nerve damage, motor conduction speed was reduced in persons with high hair mercury levels. The most common sensory effects are paresthesia, pain in limbs and visual and auditory disturbances. Motor disturbances results in changes in gait, weakness, falling, slurred speech and tremor. Other symptoms are headaches, rashes and emotional disturbances.

Endocrine system – mercury has been shown to concentrate in the thyroid and pituitary glands, interfering with their function. Impairment of adrenal gland activity also occurs.

Kidneys – mercury can accumulate in the kidneys, where it may cause kidney damage.

Possible Conditions Associated With Mercury Toxicity

adrenal gland dysfunction	depression
alopecia (hair loss)	dermatitis
anorexia	discouragement
ataxia (uncontrolled movement of limbs)	dizziness
birth defects	fatigue
blushing	hearing loss
brain damage	hyperactivity
immune system dysfunction	pain in limbs
insomnia	rashes, skin
kidney damage	salivation, excessive
loss of self-control	schizophrenia
memory loss	thyroid dysfunction
migraine headaches	timidity
mood swings	tremors
nervousness	vision loss, peripheral vision
numbness and tingling in arms and legs	weakness, muscle

Hair Analysis Testing Information

MOLYBDENUM

Sources

Animal Products – meats – pork, lamb, beef liver

Nuts/seeds – sunflower seeds

Vegetables – soybeans, lima beans, lentils, peas

Grains – buckwheat, oats, barley, wheat germ, sorghum

Occupational sources – working around metal fumes. Molybdenum is used to make stainless steel, photographic chemicals, lubricants, pigments and reagents.

Metabolism

- In the blood, molybdenum is most commonly found in a complex with copper.
- Molybdenum concentrates in the liver, kidney, bone and significant amounts are found in the dental enamel and hair.
- The main route of excretion is through the kidneys.

Roles in the Body

- Molybdenum is an ultra-trace mineral
- Molybdenum is required for xanthine oxidase, an enzyme involved in the formation of uric acid.
- In animals, another enzyme, aldehyde oxidase, also requires molybdenum. This enzyme is involved in detoxification.
- Molybdenum has been shown in animals to be involved with fat, purine and sulfate metabolism.
- It is also involved in detoxification and intimately involved in copper metabolism.

Symptoms Associated With A Molybdenum Deficiency

impaired growth	tooth decay
male impotence	xanthine stones

- Symptoms of elevated copper can result from a molybdenum deficiency.

Symptoms Associated With A Molybdenum Excess

- Acute toxicity causes severe diarrhea.
- Chronic toxicity may cause gout.
- Copper deficiency symptoms may also occur, including skin problems, hair loss, growth retardation, osteoporosis, thyroid abnormality, bone and joint abnormalities and weight loss.

Synergetic Nutrients

- Molybdenum is considered to be synergistic with iron and sulfur.
- Molybdenum also raises sodium levels and is synergistic with vitamins B₁ and B₃ (xanthine oxidase).

Hair Analysis Testing Information

MOLYBDENUM (Continued)

Antagonistic Nutrients

- Molybdenum is a powerful copper antagonist. Most copper antagonists such as zinc displace copper. A unique property of molybdenum is that it binds or complexes directly with copper and facilitates its removal. This enables copper to be removed from the body without the common side effects that often occur with copper removal.
- Another reason for this action is that molybdenum raises sodium, offsetting the sodium-lowering effect that occurs when copper is eliminated.
- Molybdenum absorption is antagonized by copper, sulfur, methionine and a high-protein diet.
- Molybdenum metabolism is antagonized by manganese, zinc and at times sulfur.

Hair Analysis Testing Information

NICKEL

Sources of Nickel

cigarette smoking	nickel plating
commercial peanut butter	oysters
herring	tea
hydrogenated vegetable oils	unrefined grains and cereals
imitation whip creams	vegetable shortening
kelp	vegetarian products

margarine

Manufacture of:

steel
batteries
machine parts
wire
electrical parts

How Nickel Affects The Body

Kidneys – nickel has a tendency to accumulate in the kidneys.

Hormone, Lipid and Membrane Metabolism – it is believed that nickel has some physiological role related to these functions.

Possible Conditions Associated With Nickel Toxicity

cancer, intestinal	low blood pressure
cancer, oral	malaise
heart attack	muscle tremors, tetany and paralysis
hemorrhages	nausea, vomiting
kidney dysfunction	skin problems

Hair Analysis Notes

- Normal nickel is about 0.1 mg% or lower.
- More research is needed regarding the physiological roles and significance of hair levels of nickel.

Hair Analysis Testing Information

PHOSPHORUS

Sources of Phosphorus

Seafood – tuna, mackerel, pike, red snapper, salmon, sardines, whitefish, scallops, shad, smelt, anchovies, bass, bluefish, carp, caviar, eel, halibut, herring, trout

Meats – liver (beef, chicken, hog, lamb), rabbit, sweetbreads, turkey, beef brains, chicken, eggs, egg yolk, lamb heart, kidney

Nuts/seeds – pine nuts, pistachios, pumpkin, sesame, sunflower, walnuts, almonds, brazil nuts, cashews, filberts, hickory, peanuts, pecans

Vegetables – chickpeas, garlic, lentils, popcorn, soybeans

Dairy – cheeses

Grains – wheat bran and germ, wild rice, buckwheat, millet, oats, oatmeal, brown rice, rice bran, rye, wheat

Miscellaneous – chocolate, kelp, yeast, bone meal

Roles In The Body

- Bone structure – 80-85% of phosphorus in the body is located in the bones and teeth
- Energy production – (ATP – adenosine triphosphate and ADP – adenosine diphosphate)
- Cell membranes – (as phospholipids)
- Genetic reactions – in DNA – deoxyribonucleic acid and RNA – ribonucleic acid
- Buffering agent, to maintain osmotic pressure

Functions of Phosphorus

Digestive – regulates absorption of calcium and a variety of trace elements. Phosphorus in excess has a laxative action

Nervous – source of adenosine triphosphate (ATP), component of the myelin sheath

Endocrine – interacts with vitamin D

Blood – red blood cell (RBC) metabolism

Muscular – adenosine triphosphate (ATP) needed for muscle contraction

Skeletal – component of bone and teeth

Immune – adenosine triphosphate (ATP) for leukocytes

Metabolic – energy production via phosphorylation reactions

Detoxification – in liver – via adenosine triphosphate (ATP)

Symptoms Associated With A Phosphorus Deficiency

arthritis	tooth decay
fatigue	stunted growth
fragile bones	weakness, muscle
reproductive problems	

Symptoms Associated With A Phosphorus Excess

anemia (iron deficiency)	hyperexcitability
arthritis	irritability
calcium and magnesium deficiency	tremors
diarrhea	zinc deficiency

Hair Analysis Testing Information

PHOSPHORUS (Continued)

Synergetic Nutrients

Absorption – sodium, potassium, low calcium diet, vitamin D, parathyroid hormone, high fat diet

Metabolic – calcium, magnesium, B-complex vitamins (in energy production)

Antagonistic Nutrients

Absorption – calcium, aluminum, iron, magnesium, vegetarian diets, vitamin D deficiency

Hair Analysis Notes

High Hair Phosphorus

- An elevated phosphorus level is frequently indicative of excessive protein breakdown of body tissues. As proteins break down, phosphorus is released.
- Phosphorus levels may increase temporarily as toxic metals are being eliminated in the course of a nutrition program.
- Very high phosphorus (greater than 25 mg%) can indicate a serious metabolic disturbance.

Low Hair Phosphorus

- A low phosphorus level is frequently associated with inadequate protein synthesis.
- Although most diets are adequate in phosphorus, those on low-protein diets or vegetarians may have a low phosphorus intake.
- Zinc is required for protein synthesis. Often a low phosphorus level is associated with a zinc deficiency, cadmium toxicity, or zinc loss. When these imbalances are corrected, the phosphorus level improves.
- A low phosphorus level may be due to poor digestion or assimilation of protein. This may be due to digestive enzyme deficiency, low hydrochloric acid level, or other factors.

Hair Analysis Testing Information

POTASSIUM

Source of Potassium

Seafood – halibut, herring, lingcod, sardines

Meats – goose

Nuts/seeds – pecans, sesame, sunflower, walnuts, almonds, brazil nuts, cashews, chestnuts, filberts, peanuts

Fruits – avocados, dates, figs, prunes, raisins

Vegetables – watercress, garlic, horseradish, lentils, parsley, potatoes, spinach, artichokes, lima beans, beet greens, Swiss chard, collards

Grains – buckwheat, rye, wheat bran

Miscellaneous – chocolate, molasses, mushrooms, kelp, yeast, salt substitutes

Roles In The Body

Potassium has many roles, especially intracellular fluid balance and cell membrane effects such as muscle contraction, nerve impulse conduction and cell permeability.

Functions of Potassium

Circulatory – lowers heart rate, dilates arteries, can reduce blood pressure

Excretory – maintains acid-base balance

Digestive – increases digestive tract activity

Endocrine – helps raise aldosterone and other hormones

Metabolic – involved in carbohydrate metabolism

Symptoms Associated With A Potassium Deficiency

allergies	low blood pressure
constipation	muscle weakness
fatigue	skin problems
irregular heart beat	slow oxidation
low blood sugar (hypoglycemia)	water retention

Symptoms Associated With A Potassium Excess

depression, mental	muscle spasms
fast oxidation	weakness, muscle
high blood sugar (diabetes)	

Synergistic Nutrients

magnesium

Antagonistic Nutrients

calcium, processed food diets are low in potassium

Hair Analysis Notes

Potassium is known as the follow-through mineral. Hair must not be washed at the laboratory to obtain accurate potassium readings.

Hair Analysis Testing Information

POTASSIUM (Continued)

High Hair Potassium:

- Indicates high sugar and glucocorticoid levels
- Very high potassium can be a potassium loss due to excessive breakdown of body cells.

Low Hair Potassium:

- Indicates adrenal gland exhaustion
- Very low potassium is associated with allergies, fatigue, low blood sugar, sweet cravings and low blood pressure.

Reasons For Potassium Supplementation

- To lower a high sodium/potassium ratio
- To enhance energy production

Hair Analysis Testing Information

SELENIUM

Sources of Selenium

Seafood – oysters, tuna, mackerel, herring, lobsters, scallops, shrimp, pike, trout, carp, cod, flounder, salmon

Meats – liver, kidney, heart, beef, lamb, egg, pork

Nuts/seeds – brazil nuts, cashews, peanuts, walnuts

Grains – wheat germ and bran, brown rice, barley

Miscellaneous – brewer's yeast

Roles In The Body

- At the molecular level selenium as a sulfhydryl agent, anti-oxidant (glutathione peroxidase) and as a synergist to vitamin E.
- At the cellular level selenium is involved in the destruction of peroxides, protection of cell membranes, as an electron transfer agent and in glutathione metabolism.
- Selenium helps maintain the circulatory system, digestive organs and reproductive system. It is also involved with heavy metal detoxification.

Functions Of Selenium

Circulatory – needed for the heart muscle

Excretory – protection from toxic metals

Respiratory – involved in oxygen transport

Digestive – intestinal homeostasis

Nervous – protection from mercury and cadmium

Reproductive – protection against birth defects

Endocrine – synergistic with the sex hormones

Blood – stabilizes the red blood cell membranes

Integumentary – helps maintain hair, skin and nails

Immune – enhances immune system in animals

Metabolic – lipid and sulfhydryl metabolism; may prevent liver necrosis

Detoxification – helps remove mercury, cadmium, silver, arsenic and peroxides

Possible Symptoms Associated With Selenium Deficiency

acanthocytosis	neonatal jaundice
alcoholic liver failure	toxic metal poisoning

Possible Symptoms Associated With Excessive Selenium

depression	nervousness
dermatitis	pallor
gastrointestinal distress	possibility of malignancy
liver damage	selenosis
mottled teeth	

Nutrients That Are Synergistic With Selenium

Metabolic – vitamin C, vitamin E, glutathione

Absorption – amino acids, peptides, proteins

Hair Analysis Testing Information

SELENIUM (Continued)

Antagonistic Nutrients

Metabolic – silver, arsenic, mercury, cadmium, titanium

Absorption – copper, mercury, silver, sulfate

Hair Analysis Notes

High Hair Selenium:

- Can be due to the use of shampoos containing selenium
- May indicate a loss of selenium through the hair

Low Hair Selenium:

- May be due to dietary deficiency, which is relatively common, especially among those who eat refined foods.

Reasons For Selenium Supplementation

Selenium may be given to help prevent or correct cadmium, mercury, or arsenic toxicity. Selenium is an anti-oxidant and may be given to help protect against free radical damage. Note that excessive selenium supplementation may be toxic.

Hair Analysis Testing Information

SODIUM

Sources of Sodium

Seafood – tuna, clams, caviar, lobster, sardines, scallops, shrimp

Meats – brains, eggs, beef kidneys, beef liver

Vegetables – beet greens, celery, Swiss chard, olives, peas

Dairy – butter, buttermilk, cheeses

Miscellaneous – pickles, table salt, soy sauce, steak sauce, kelp, brewer's yeast, drinking water from water softeners. Processed and fast foods are often high in salt content.

Roles In The Body

Sodium is an extracellular element, involved in fluid balance, regulation of blood pressure and cell membrane permeability.

Functions of Sodium

Circulatory – maintenance of blood pressure, increases heart rate

Excretory – helps maintain acid-base balance

Digestive – required to produce hydrochloric acid in the stomach

Endocrine – reduces aldosterone secretion

Detoxification – keeps toxic substances in solution

Symptoms Associated With A Sodium Deficiency

allergies	fatigue
anorexia	low blood pressure
apathy	low hydrochloric acid
bloating, abdominal	poor protein digestion
depression, mental	slow oxidation rate
dizziness	weakness

Symptoms Associated with a Sodium Excess

edema	irritability
fast oxidation rate	lowers calcium and magnesium levels
headaches	nervousness
high blood pressure	water retention

Synergistic Nutrients

Absorption – glucose

Metabolic – manganese, chromium, vitamin C, E and B complex

Antagonistic Nutrients

Absorption – calcium

Metabolic – zinc, choline, inositol

Hair Analysis Notes

Sodium is referred to as the volatility mineral

Hair Analysis Testing Information

SODIUM (Continued)

Low Hair Sodium:

- Excellent indicator of impaired adrenal gland activity
- Very low sodium is indicative of exhaustion
- Hair must not be washed at the laboratory for accurate readings

High Hair Sodium:

- Indicative of excessive adrenal gland activity
- Often indicates excitability and fast oxidation
- Sodium levels can be elevated by toxic metals, especially cadmium

Supplementing Sodium

Salt consumption can be harmful if excessive, or if blood pressure is elevated. Slow oxidizers with low sodium levels and low blood pressure often feel better when they use sea salt or soy sauce in cooking.

Hair Analysis Testing Information

ZINC

Sources of Zinc

Seafood – oysters, herring

Meats – beef, lamb, beef and pork liver

Nuts/seeds – sunflower, pumpkin

Dairy – cheese

Grains – wheat germ

Miscellaneous – brewer's yeast, maple syrup, bone meal, gluten, tea

Roles In The Body

- Activator of many key enzymes
- Growth and development
- Male reproductive system
- Insulin production and secretion
- Prevention of cadmium and copper toxicity

Functions of Zinc

Circulatory – maintenance of artery walls

Respiratory – removal of carbon dioxide and maintenance of acid-base balance

Digestive – production of digestive enzymes and normal liver function

Nervous – essential for brain development and neurotransmitters

Special senses – appetite regulation, smell and taste

Reproductive – testes, ovaries, prostate, male fertility

Endocrine – insulin and pituitary gonadotropin secretion

Blood – red blood cells and blood proteins

Skeletal – bone integrity, prevention of osteoporosis

Skin – required for normal integrity of hair, nails and skin

Protective – required for wound healing and integrity of the immune system

Metabolic – normal carbohydrate and protein metabolism

Detoxification – assists in removing toxic accumulation of cadmium and copper

Psychological – powerful mood stabilizer and “sedative” mineral

Symptoms Associated With A Zinc Deficiency

alcoholic cirrhosis	diabetes
arteriosclerosis	emotional problems
cadmium toxicity	failure to thrive
carbohydrate intolerance	fatigue
copper toxicity	hypoglycemia
conditions due to birth defects	hypothyroidism
impotence	nervousness
lack of taste and smell	poor wound healing
low appetite	prostate problems

Symptoms Associated With A Zinc Excess

anemia, iron deficiency	nausea
depression, mental	vomiting
diarrhea	

Hair Analysis Testing Information

Synergetic Nutrients

Magnesium, vitamin A, D, E, B₆, high-protein diet

Antagonistic Nutrients

Absorption – copper, cadmium, iron, chromium, manganese, selenium, phytic acid, vegetarian diets, soy, cereals, fiber in diet

Metabolic – copper, iron, cadmium

Hair Analysis Notes

Zinc is considered a “masculine” mineral, because of its importance in the formation of male sexual hormones.

High Hair Zinc:

- An elevated zinc level is commonly due to a loss of zinc from the body tissues. In these cases, zinc supplements will often be recommended.
- Zinc levels may appear high to help compensate for copper toxicity. Thus high zinc can be a tipoff of a hidden copper toxicity.
- Use of Head and Shoulders shampoo occasionally results in an elevated zinc reading.
- Cadmium toxicity can cause a zinc reading to appear high.

Low Hair Zinc:

- Zinc will often read low if the sodium/potassium ratio is less than 2.5:1. In this case, it is not always wise to give much zinc.
- Zinc is commonly low in “fast” oxidizers.
- Very low zinc levels are often associated with emotional instability and with problems of growth and development in children.