Elemental Analysis Hair

Great Smokies Diagnostic Lab

63 Zillicoa Street
Asheville, NC 28801-1074

Patient:

Age: 32
Sex: M
MRN: 0000863835

Order Number: 73120434
Completed: January 16, 2006
Received: January 12, 2006
Collected: December 27, 2005

Toxic Elements

Element	Reference Range	Reference Range in µg/g
Aluminum	1.5	<= 17.3
Antimony	0.002	<= 0.016
Arsenic	0.053	<= 0.080
Barium	0.11	<= 1.70
Bismuth	<dl	<= 0.178
Cadmium	0.003	<= 0.022
Gadolinium	<dl	<= 0.0005
Lead	0.249	<= 0.700
Mercury	0.60	<= 1.32
Nickel	0.06	<= 0.55
Rhodium	0.0002	<= 0.0005
Rubidium	<dl	<= 0.040
Thallium	<dl	<= 0.0004
Tin	<dl	<= 0.149
Uranium	0.0162	<= 0.0057

Nutrient Elements

Element	Reference Range	Reference Range in µg/g
Calcium	437	192-1,588
Chromium	0.39	0.01-1.58
Cobalt	0.003	0.001-0.129
Copper	26	8-136
Iron	9.0	5.2-24.4
Lithium	<dl	0.056-0.302
Magnesium	19	11-122
Manganese	0.15	0.04-1.93
Molybdenum	0.03	0.01-1.24
Phosphorous	126	104-206
Potassium	<dl	1-174
Selenium	0.52	0.58-1.13
Sodium	2	14-426
Strontium	0.98	0.01-4.40
Sulfur	47,623	41,781-60,894
Vanadium	0.092	0.003-0.108
Zinc	168	119-245

Ratios

	Inside Range	Outside Range	Reference Range
Ca/Mg	23		5-29
Ca/P	3		1-9

Reference ranges are derived from a healthy adult population without hair treatments such as perms, dyes, or bleach.

Commentary

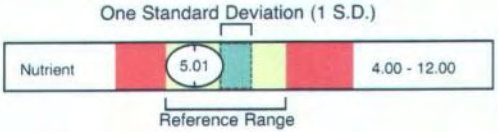
Bismuth Reference Range Update

A recent Quality Control review of Hair Element testing resulted in the update of the Bismuth reference range. This report includes the new reference range. A statistical analysis was performed on the data, in compliance with NCCLS guidelines and recommendations for reference ranges.

This test has been developed and its performance characteristics determined by Genova Diagnostics, Inc. It has not been cleared or approved by the U.S. Food and Drug Administration.

Commentary is provided to the practitioner for educational purposes, and should not be interpreted as diagnostic or treatment recommendations. Diagnosis and treatment decisions are the responsibility of the practitioner.

The **Reference Range** is a statistical interval representing 95% or 2 Standard Deviations (2 S.D.) of the reference population. One Standard Deviation (1 S.D.) is a statistical interval representing 68% of the reference range population. Values between 1 and 2 S.D. are not necessarily abnormal. Clinical correlation is suggested. (See example below)



Calcium (Ca) level is within the reference range. Hair Ca correlates with long term dietary intake, absorption from the GI tract and retention. The hair Ca level does not necessarily reflect current serum calcium or calcium ion concentrations and may not have a linear or direct relationship with tissue deposition or bone density.

Cobalt (Co) level is within the reference range.

Chromium (Cr) levels are within the reference range. Hair Cr has been reported to correspond to nutritional and physiological status.

The lab report lists three elements in a grouping entitled "Additional Elements" . Hair iron is not usually reflective of iron status. Additionally, elevated hair iron may be found in smokers, x- ray technicians and individuals with certain forms of cancer. Notably low or high hair phosphorus is consistent with abnormal calcium and/or magnesium metabolism. Hair phosphorus also is typically elevated with kidney dialysis, and appears to be depressed in chronic hepatitis.

Lithium (Li) is below the reference range. Hair Li has been reported to correlate with tissue levels and with long term dietary intake of Li. Additionally, Li levels have been reported to correlate with lithium therapy.

At low levels, Li helps in the regulation of inositol metabolism, down regulation of Na,K ATPase activity and modification of K+ activity as an enzyme activator. Li assists in regulating neurotransmitter concentrations in neurons. Deficient Li levels may or may not affect these processes to the point of physiological impairment. Symptomatology is uncertain for subnormal Li. Some reports suggest mental depression, antisocial and/or bipolar behavior may result from subnormal Li.

Manganese (Mn) is within the reference range.

Potassium (K) is below the reference range in hair. Potassium is critical for normal nutrient transport into the cell. A deficiency can result in muscular weakness, depression and lethargy. Excess of sodium may manifest itself as low hair potassium.

Rubidium (Rb) is below the reference range. Hair reflects long term Rb ingestion and status of Rb in body tissues.

Commentary

Normally, hair Rb level tracks hair potassium level; deviations may occur in cancer. Hair Rb also correlates with Rb therapy for malignancies and for manic depressive conditions.

Rubidium functions include modifications of potassium activity as an enzyme activator and modification of transport processes across cell membranes. Symptomatology of subnormal Rb is uncertain and may be nonexistent. However, epidemiological and biochemical research suggest lower cancer rates in countries with higher dietary Rb and decreased tumor number and mass in animals fed carcinogens if they also ingested low (physiological) levels of Rb.

Selenium (Se) is below the reference range in hair. Hair selenium correlates with tissue selenium. The 4 natural oxidation states of selenium are elemental selenium (0), selenide (-2), selenite (+4), and selenate (+6). Inorganic selenate and selenite predominate in water whereas organic selenium compounds (selenomethionine, selenocysteine) are the major selenium species in cereal and in vegetables. The toxicity of most forms of selenium is low and the toxicity depends on the chemical form of selenium. Several lines of scientific inquiry suggest that an increased risk of cancer occurs as a result of low concentrations of selenium in the diet; however, insufficient evidence exists at the present time to recommend the use of selenium supplements for the prevention of cancer.

Sodium (Na) is below the reference range in hair. Sodium/Potassium ratio is also significantly decreased in participants with BMI>35. An optimal sodium/potassium ratio is ~2.5, with ratios of 1 associated with joint pain, allergies, digestive dysfunction, and altered glucose metabolism. Vitamin B1 enhances sodium retention.

Sulfur (S) level is within the reference range.

Uranium (U) is above the reference range. Hair levels of uranium may reflect past or chronic ingestion. Most exposure comes from natural uranium in ground and drinking water. The U238 isotope of uranium is measured by GSDL, and this isotope comprises more than 99% of naturally occurring uranium. Radioactivity danger from trace quantities of natural uranium is slight because of its very long half life (billions of years). The finding of elevated U238 in this test does not imply nor does it rule out exposure to enriched uranium fuel (U235) or to other radioactive isotopes which may be radiation hazards.

The major toxicological concern of U238 excess is biochemical rather than radiochemical. U is a reactive element which is able to combine with and affect the metabolisms of: lactate, citrate, pyruvate, carbonate and phosphate. Eventually, U deposits in kidney, bone, liver and spleen. The primary symptom of low level chronic uranium excess is chronic fatigue. Possible conditions from more severe uranium contaminations include damage to kidney glomeruli with disordered renal transport (proteinuria, albuminuria, and hyperaminoaciduria) and hematopoiesis in bone marrow.