TEST REPORT

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ZRT LABORATORY

 # 2018 08 09 100 B

Ordering Provider:
Jane Getuwell, MD

Samples Received
08/09/2018

Report Date
08/14/2018

Samples Collected
Blood Spot - 07/31/18 08:00

Patient Name: Toxic & Essential Elements - Blood
Patient Phone Number: 555 555 5555

Gender	Height	Waist
Male	180 cm	Unspecified
DOB	**Weight**	**BMI**
7/23/1963 (55 yrs)	82 kg	25.3

TEST NAME	RESULTS | 07/31/18	RANGE
Blood Spot Elements		
Zinc	7.26	5.04-8.46 mg/L
Copper	0.70	0.59-1.03 mg/L
Ratio: Zn/Cu	10.4	6.6-10.8
Magnesium	42	27-49 mg/L
Selenium	133	116-314 µg/L
Cadmium	<0.22	<1.04 µg/L
Lead	5.48 H	<2.23 µg/dL
Mercury	15.10 H	<5.29 µg/L

<dL *= Less than the detectable limit of the lab.* ***N/A*** *= Not applicable; 1 or more values used in this calculation is less than the detectable limit.* ***H*** *= High.* ***L*** *= Low.*

Therapies

None Indicated

Lab Comments

ZINC

Whole blood zinc is within normal reference range.

Zinc is an essential element that is a co-factor in over 300 enzymes, and is required for cell growth and division, DNA synthesis, wound healing, taste, immune and thyroid function, blood clotting, reproduction, tissue growth, prevention of oxidative damage, and many other catalytic, structural and regulatory functions. Proper zinc nutrition has been shown to reduce the absorption of lead and prevent kidney damage caused by cadmium. Generally, zinc absorption is greater when animal protein intake (e.g., eggs, beef, cheese) is high because released amino acids help to keep zinc in solution allowing optimal absorption. Phytates (present primarily in legumes and whole grains) chelate zinc and inhibit its absorption. Vegetarians and vegans, who consume elevated levels of plant-based phytates and low levels of animal proteins in foods, are more likely to be zinc deficient and often require more supplemental zinc in their diet. Alcohol consumption can also prevent zinc absorption due to reduced uptake and increased urinary excretion.

The current RDA for zinc is 8 mg/day for women and 11 mg/day for men while requirements are lower for children and higher during lactation or pregnancy. Zinc should always be well balanced with copper (see below). The primary sources of dietary zinc are red meat and poultry, with

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other good sources being oysters, beans, nuts, seafood, whole grains, fortified cereals, and dairy products.

For more information, you can find a review of zinc and the zinc/copper balance at: http://www.omicsonline.org/copper-and-zinc-biological-role-and-significance-of-copper-zincimbalance-2161-0495.S3-001.pdf

COPPER

Whole blood copper is within normal reference range.

Copper is an essential element required for antioxidant defense, immune function, neuron formation, iron metabolism, and as a cofactor of critical enzymes and proteins. The body contains around 100 mg copper, with the highest concentrations in the brain and liver. Copper absorption occurs primarily in the small intestine and stomach where a high pH causes copper to break apart from dietary macromolecules. In the bloodstream copper is transported by albumin and transcuperin to the liver where it binds to the copper binding protein ceruloplasmin. Adrenal hormones promote ceruloplasmin production, so liver and adrenal gland dysfunction can cause copper to accumulate in tissues and organs. Typically, copper homeostasis is well maintained and toxicity is prevented via biliary excretion.

The current RDA for copper is 0.9 mg/day for both men and women, although an argument has been made for a higher intake of 2.3 mg/day. Common sources of dietary copper include animal products, legumes, grains, and vegetables. Copper water pipes, cookware, drinking water, birth control, fungicides, and dietary supplements are all potential sources of copper exposure. Drinking water contributes about 6-13% of the average daily intake of Copper. Most diets contain enough copper (1-5 mg) to prevent a deficiency.

For more information, you can find a review of copper and the zinc/copper balance at: http://www.omicsonline.org/copper-and-zinc-biological-role-and-significance-of-copper-zincimbalance-2161-0495.S3-001.pdf

MAGNESIUM

Whole blood magnesium is within normal reference range.

Magnesium is an essential element and co-factor in approximately 600 enzyme systems. It is required for protein synthesis, reproduction, DNA and RNA synthesis, cellular energy production and storage, muscle and nerve function, blood glucose control, blood pressure regulation, along with many other vital bodily functions. Significant evidence shows that magnesium intake is inversely associated with the risk of stroke. The human body contains between 21-28 g of magnesium; approximately 53% is in bone, 27% in muscle, 19% in soft tissues, 0.5% in erythrocytes, and 0.3% in serum. After oral intake, around 40-50% of dietary magnesium is absorbed in the small intestine. Dietary intake of calcium, phosphate, and potassium can competitively inhibit gut absorption of magnesium. It is estimated that 60% of Americans do not consume the daily recommended amount of magnesium, with the elderly the most vulnerable population due to decreased gut absorption and renal excretion. Magnesium homeostasis is primarily controlled by the kidney, aiding in prevention of deficiency or toxicity.

The current recommended dietary allowance (RDA) for magnesium is 420 mg/day for men and 320 mg/day for women in adults. Magnesium content of soil has decreased 20-30% over the last 60 years, and it is estimated that 80-90% of magnesium is lost during food processing of whole grains. Foods highest in magnesium are whole grains, nuts, legumes, potatoes, and dark leafy vegetable.

For an excellent and easy-to-read online mini-review on magnesium published in April 2016 in Food & Nutrition please search: Magnesium: The Missing Mineral? by Julia Greenwald Jay.

For online reviews on magnesium please see:
https://ods.od.nih.gov/factsheets/Magnesium-HealthProfessional/
http://advances.nutrition.org/content/4/3/378S.long
http://physrev.physiology.org/content/95/1/1.long

SELENIUM

Whole blood selenium is within the normal reference range. Whole blood selenium levels represent long-term exposure while urine selenium levels reflect recent intake.

Selenium is an essential element that has an important role in thyroid hormone metabolism, antioxidant function (i.e. through glutathione), and redox status. Selenium supplementation has been shown to increase the effectiveness of cancer therapy or help prevent certain types of cancer such as lung, colon, bladder, and prostate. Low selenium is closely associated with thyroid diseases such as Hashimoto's thyroiditis as well as decreased conversion between T4 and T3.

Selenium serves as a detoxifying agent, preventing tissue damage by forming tight ionic complexes with heavy metals such as mercury, arsenic, lead, and cadmium. The selenium-heavy metal complex neutralizes heavy metals preventing them from creating reactive oxygen species (ROS) that damage tissues. If heavy metal exposure is high, it is essential that selenium intake is high enough maintain adequate levels of selenium-containing antioxidant enzymes and neutralizing complexes.

For more information, you can find a review of selenium at: http://www.nature.com/ejcn/journal/v58/n3/full/1601800a.html

The above results and comments are for informational purposes only and are not to be construed as medical advice. Please consult your healthcare practitioner for diagnosis and treatment.

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CADMIUM

Whole blood cadmium is within the normal reference range, which should be considered beneficial as it indicates low recent exposure to cadmium. High-normal cadmium should be cross-checked with urinary cadmium which better reflects long-term exposure to cadmium. Cadmium bioaccumulates in the body, meaning that at birth levels are low, but by age 30 the body burden may reach toxic levels that adversely affect health. The half-life of cadmium in the kidneys is 15-30 years making urine an ideal body fluid to assess lifetime exposure to cadmium.

Cadmium is a non-essential toxic element and a kidney toxin, peripheral nerve toxin, an estrogen mimic, and a group 1 carcinogen. Elevated levels of cadmium are believed to play a role in the development of lung, prostate, breast, endometrial, testicular, kidney, bladder, pancreatic and gall bladder cancer. The major sources of cadmium exposure are from vegetables, grains, tobacco, seafood, organ meats, and root crops all which take up and accumulate cadmium from the soil. Lung absorption can be up to 50%, which is why cadmium in the urine of smokers is double that of non-smokers. Human activities and products such as mining, smelting, artisan glass manufacturing, waste disposal, fertilizer, pesticides, nickel-cadmium batteries, and vehicle exhaust all contribute to environmental and occupational cadmium exposure.

Avoiding sources of cadmium esp smoking, and maintaining adequate zinc, selenium and fiber intake can continue to prevent cadmium toxicity. For more information, you can find a review of cadmium at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3686085/

LEAD

Whole blood lead is higher than reference range (confirmed on retesting), but not considered actionable by the CDC. The Center for Disease Control (CDC) considers blood lead to be elevated at 10 µg/dl for adults and 5 µg/dl for children. Consider means to identify and avoid further exposure. Please talk to your healthcare provider.

The most common source of exposure is lead paint and paint dust. About one in three housing units in the United States has lead based paint hazards. Leaded gasoline (banned 1996), lead paint (banned 1978) and lead-soldered copper pipes (banned 1986), mining operations, and other industrial applications are also common. Lead is also found in ammunition, paints, ceramics, artisan glassware, hair dye, and cosmetics. Toys, jewelry, pottery and medicine from overseas has also been a problem. In the United States occupational exposure is the main cause of lead poisoning in adults. About 15-20% of total lead exposure is attributed to lead released from old pipes used to deliver drinking water.

Lead is a non-essential toxic element that can affect all organs in the body, including the nervous, skeletal, urinary, cardiovascular, immune, gastrointestinal and reproductive systems. The brain is the most sensitive organ to lead exposure due to damage to neurons and interference with neurotransmitters, specifically glutamate which is required for development and learning. High lead levels have been linked to an increased risk of stroke and heart disease along with higher mortality rate. Documented as a probable human carcinogen, lead has been associated with cancers of the brain, kidney, stomach, lung, and meninges. Leads toxic action is a result of its ability to mimic and replace other essential elements such as calcium, zinc, copper, magnesium, sodium, and iron. Once lead is ingested (10% absorption) or inhaled (50% absorption) it is bound to hemoglobin in red blood cells and transported and deposited in different organs throughout the body. Children and pregnant women absorb around 50% of ingested lead, making them more susceptible to lead toxicity. Leads half-life in blood is around 40 days, which is about the same as the half-life of a red blood cell. Approximately 95% of lead that is absorbed will be stored in the bones with a half-life of around 25 years. Even after the exposure has ceased, lead can be re-introduced into the bloodstream from bone, meaning that blood levels indicate both current and past exposure. As people age, bone breaks down and this can increase lead exposure to other organs.

For more information, you can find a review of lead at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3485653/pdf/ITX-5-047.pdf or http://www.cdc.gov/nceh/lead/tips.htm

MERCURY

Whole blood mercury is higher than the reference range.

Mercury is a potent toxin. Mercury is found in 3 basic forms in the body: elemental mercury (HgO), inorganic mercury (Hg2+), and organic mercury (MeHg). High mercury exposure can cause symptoms which include balance problems, hearing loss, speech issues, and damage to peripheral nerves (tingling sensation). If selenium and/or zinc levels are low in concert with high whole blood mercury, it is recommended that they be increased to protect against antioxidant functions. The half-life of mercury in the brain is estimated at 20 years. There mercury is bound strongly to sulfur and selenium groups. Metallothioneins are proteins rich in sulfur residues and upregulated by zinc intake. They preferentially bind heavy metals such as mercury and cadmium, preventing them from causing further damage. Natural sources of mercury are volcanoes, weathering of rock, oceans, soil, and burning vegetation. It is estimated that 50-75% of environmental mercury comes from human activity; with the largest sources of mercury being coal fired power plants, gold mines, and metal and cement production.

Elemental Mercury (Hg0)

There is very little absorption of elemental mercury in the GI tract, but nearly 80% is absorbed by the lungs as a vapor. Absorbed elemental mercury is oxidized to inorganic forms of mercury, but remains a vapor long enough in the blood for a significant amount to penetrate the blood-brain barrier. Sources of elemental mercury include light bulbs, mines, industrial manufacturing, dental amalgams, and thermometer production. Dental amalgams, which are 50% mercury, gas off between 2-28 µg elemental mercury/day, of which 80% is absorbed. Elimination of elemental mercury, which is converted to inorganic mercury in the body, is through urine and feces.

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Inorganic Mercury (Hg2+)

Inorganic mercury can reach most organs, but primarily accumulates in the kidneys where it does the most damage. Most pharmaceutical and agricultural uses of inorganic mercury have been discontinued, but mercury chloride is still used as a pesticide and disinfectant. Essentially all mercury in urine is inorganic, whereas that in whole blood, mostly found in red blood cell membranes, is organic (e.g., methylmercury).

Organic Mercury (Methylmercury)

Methylmercury is the most common and toxic form of mercury. It is nonpolar and accumulates in fatty tissues such as the plasma membranes of red blood cells and other fatty tissues like the brain. Methylmercury is purported to be 100 times more toxic than elemental or inorganic mercury. Atmospheric elemental and inorganic mercury is converted by microorganisms in water to organic mercury, which works its way up the food chain and bioaccumulates. Fish at the top of the food chain (tuna, shark, swordfish) have the highest levels of mercury, with 95-97% present as organic mercury. Nearly all methylmercury consumed in foods such as fish is absorbed by the GI tract. Once in the blood a majority of methylmercury binds to sulfur or selenium groups, with up to 10% accumulating in the brain. Most of the toxic effects of methylmercury are on the CNS, although the immune system and kidneys are affected as well. About 95% of mercury in blood is methylmercury, with the majority residing in red blood cells. This makes whole blood an ideal matrix to evaluate methylmercury burden. The half-life of methylmercury in blood is about 50 days, so whole blood analysis represents recent and past exposure to mercury.

For more information, you can find a review of mercury at:
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3253456/
https://www3.epa.gov/ttn/atw/hlthef/mercury.html

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