

UPCOMING EVENTS

**Interpreting Heavy Metals:
Selecting the Correct Test and
Building a Clinical Plan**

**Presented by Dan Kalish, DC, IFMCP
October 20, 2026 at 12 PM Pacific**

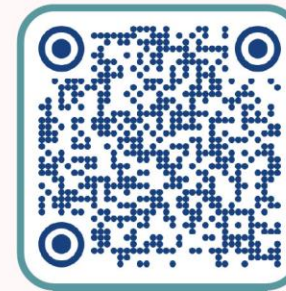
**The Aging Gut-Brain Axis:
Dysbiosis, Intestinal
Permeability, and Inflammaging
in Clinical Practice**

**Presented by Julia Malkowski, ND, DC
November 4, 2026 at 12 PM Pacific**

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WILL BEGIN SHORTLY



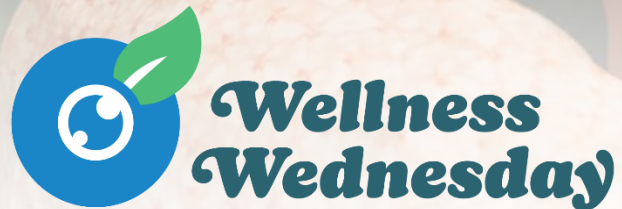
MORE WEB EVENTS

Elemental Archive: Hair as an Indicator of Toxic Exposure and Nutritional Element Status

Jeannie Gorman, MS, CCN

Clinical Education Specialist

Doctor's Data, Inc.





SCIENCE + INSIGHT



**Qualifications
and Licensing**

For 50+ years, DDI has been recognized and respected by many American and European regulating and governing agencies.

- ✔ Doctor's Data is a federally licensed CLIA laboratory with appropriate state certifications and licenses.
- ✔ We participate in quality assurance and proficiency testing programs including those offered by the College of American Pathology (CAP), Centers for Disease Control (CDC), New York State Department of Health, Le Centre de Toxicologie du Quebec and others.
- ✔ DDI is an approved provider for the Joint Research Centre of the European Commission: Reference Material Unit
 - ✔ We assist with the certification of reference materials
 - ✔ We do the same for the NY State Department of Health

Session Objectives:



Hair Elements

By the end of this presentation, participants will be able to:

- Explain the biological basis and rationale for using hair as a matrix for elemental assessment.
- Evaluate hair element results within the context of laboratory methodology, reference ranges, specimen collection, and potential sources of variability.
- Differentiate findings that may warrant clinical consideration from those requiring confirmation or additional context.
- Recognize when follow-up testing or additional exposure assessment may be appropriate.

Order: Sample Report

Test: Sample ID
Client #: 12345
Doctor's Data, Inc.
3755 Illinois Ave.
St. Charles, IL 60174 USA

Id: Patient ID

Age: 64 Di
Sex: Female
Sample Ty:
Shampoo:
Sample Siz

Analyte	Result
Arsenic* (As)	0.053
Lead* (Pb)	0.05
Mercury* (Hg)	0.70
Cadmium* (Cd)	0.005
Thallium* (Tl)	<0.0004
Thorium* (Th)	0.0006
Antimony* (Sb)	0.046
Beryllium* (Be)	<0.0003
Barium* (Ba)	0.12
Uranium* (U)	0.003
Bismuth* (Bi)	0.033
Palladium* (Pd)	<0.0006
Platinum* (Pt)	<0.0002
Tungsten* (W)	0.001
Cesium* (Cs)	0.0002
Gold* (Au)	0.013
Gadolinium* (Gd)	<0.0002
Tellurium* (Te)	<0.015
Aluminum* (Al)	0.9
Nickel* (Ni)	0.06
Silver* (Ag)	0.073
Tin* (Sn)	0.05
Titanium* (Ti)	0.02
Zn/Cd (Ratio)	30000
Ca/Pb (Ratio)	2880
Se/Hg (Ratio)	1
Total Toxic Representation	

Order: Sample Report

Test: Sample ID
Client #: 12345
Doctor's Data, Inc.
3755 Illinois Ave.
St. Charles, IL 60174 USA

Id: Patient ID

Age: 64 DOB: 00/00/1960
Sex: Female
Sample Type: Head
Shampoo: Tates Hair Color: Blond
Sample Size: 0.1 g

Sample Collection

Date Collected
Date Received
Date Reported

Date/Time
09/06/2026
09/07/2026
09/08/2026

Analyte	Result	Unit	Percentile	Reference Interval
Calcium* (Ca)	144	µg/g	2.5 th 16 th Mean 84 th 97.5 th	300 – 1200
Magnesium* (Mg)	30	µg/g		35 – 120
Sodium* (Na)	8	µg/g		15 – 120
Potassium* (K)	2	µg/g		3 – 50
Copper* (Cu)	8.0	µg/g		11 – 30
Zinc* (Zn)	150	µg/g		170 – 240
Manganese* (Mn)	0.42	µg/g		0.06 – 0.50
Chromium* (Cr)	0.07	µg/g		0.03 – 0.2
Vanadium* (V)	0.0030	µg/g		0.002 – 0.04
Molybdenum* (Mo)	0.58	µg/g		0.02 – 0.04
Boron* (B)	0.82	µg/g		0.2 – 1
Iodine* (I)	27	µg/g		0.25 – 1.8
Lithium* (Li)	0.020	µg/g		0.003 – 0.020
Phosphorus* (P)	77	µg/g		100 – 140
Selenium* (Se)	0.71	µg/g		0.4 – 0.7
Strontium* (Sr)	1.3	µg/g		0.50 – 7.6
Sulfur* (S)	45800	µg/g		44000 – 50000
Cobalt* (Co)	0.0099	µg/g		0.003 – 0.04
Iron* (Fe)	5.9	µg/g		6 – 15
Rubidium* (Rb)	0.0050	µg/g		0.004 – 0.04
Ca/Mg (Ratio)	4.8			6 – 16
Ca/P (Ratio)	1.87			2 – 12
Na/K (Ratio)	4.00			0.8 – 10
Zn/Cu (Ratio)	18.8			8 – 21

Hair Toxic and Essential Elements Profile

- 23 toxic element exposures
- 22 essential elements
- 7 elemental ratios
- Total Toxic Representation (weighted %)

* Reference ranges pertain to optimal levels

Enhanced Hair Toxic & Essential Elements Profile

Expanded Toxic Elements:

- ✔ Cesium
- ✔ Gadolinium
- ✔ Gold
- ✔ Palladium
- ✔ Tellurium
- ✔ Tungsten

New Essential Element ratios:

- ✔ Calcium/Lead
- ✔ Selenium/Mercury



Hair Elements

Removed Elements:

- ✔ Zirconium
- ✔ Germanium

Increased sensitivity allowing lower detection

Updated reference ranges



Historical Perspective: More than a Century of Hair Analysis

Dr. Felix Hoppe-Seyler (1825–1895)

- 🌐 German physician and chemist and a founder of modern biochemistry
- 🌐 Championed earliest investigations of trace elements in human tissues
- 🌐 First reported the detection of arsenic in human hair from an exhumed body, representing one of the earliest documented applications of hair in elemental analysis

Current Science and Analytical Advances



- 🔍 **Analytical reliability***: Modern ICP-MS Triple Quad supports sensitive, multi-element analysis
- 🔍 **Established applications**: Validated biomonitoring tool for certain elements, particularly MeHg
- 🔍 **Longer-term perspective**: May reflect elemental exposure over previous months
- 🔍 **Complementary insights**: Adds context alongside blood and urine testing
- 🔍 **Element-specific interpretation**: Hair concentrations do not consistently reflect systemic levels or predict health effects, but there is scientific evidence related to some of the markers

* Analytical reliability depends on proper collection, sample preparation, validated methodology, and laboratory quality-control procedures.
Source: Adapted from principles discussed in U.S. EPA 600/4-79-049 and ATSDR's Hair Analysis Panel Discussion.

Choosing the Appropriate Testing Matrix



Stool reflects mainly dietary exposure, previous **24-48 hours**



Whole Blood reflects **days to weeks of exposure**, standard of care



Urine denotes **2 weeks of exposure** (current/ongoing exposure)



RBC and Hair represents **~2-3 months of exposure** to screen for elements

Important Limitations of Hair Testing



- 🔍 What is the exact source of exposure?
- 🔍 What organ damage, if any, has occurred?
- 🔍 Does a low essential-element result prove deficiency?
- 🔍 Does the result establish clinical toxicity?

Hair Shaft Incorporation and Growth



- 🌱 **Blood:** Delivers elements to the developing hair matrix
- 🌱 **Systemic incorporation:** Elements may bind to keratin or associate with melanin
- 🌱 **Deposition:** Elements are retained within the keratinized hair shaft
- 🌱 **External deposition:** Sweat, sebum, water, dust, and hair products may influence results

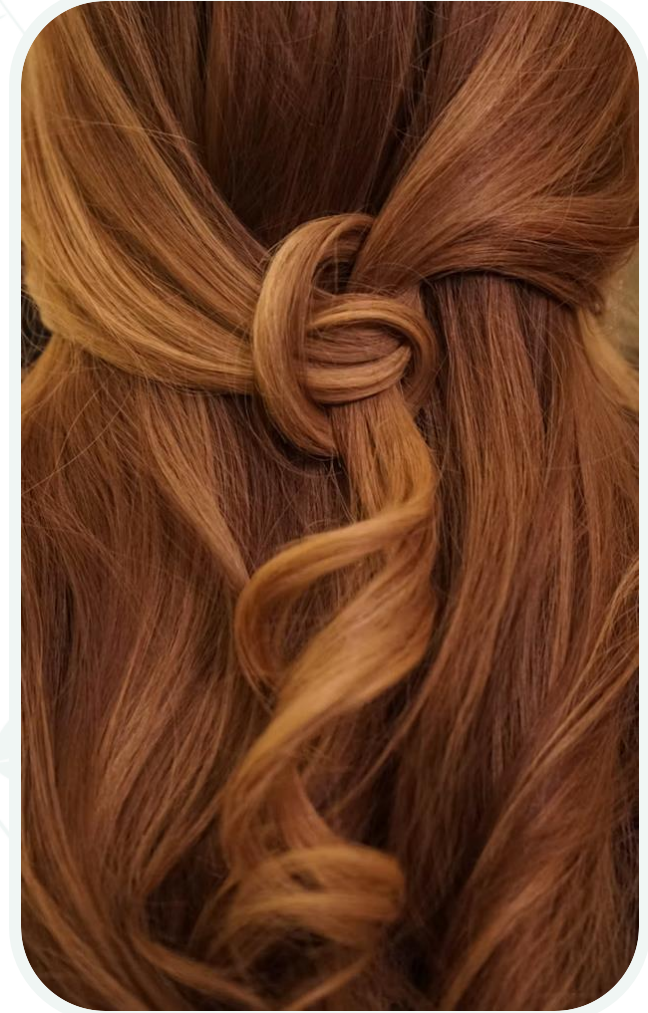
The Importance of Elemental Mixtures



- Environmental exposures often involve **multiple elements simultaneously**, rarely in isolation
- Multi-element hair analysis can identify **patterns of potential exposure**
- Recent studies have linked **combined** toxic metal exposure with:
 - Neurodevelopment
 - Cardiometabolic health
 - Pregnancy outcomes
- Emerging evidence suggests mixtures of metals may have **additive, synergistic, or antagonistic interactions**

Benefits of Testing for Hair Elements Together?

- Provides a broader elemental profile
- Allows patterns to be considered together
- Helps put toxic-element findings into nutritional context
- One specimen can answer multiple elemental questions
- Supports more focused follow-up





Elements May Interact in Combination



Example	Relationship	Clinical Context
Pb + Cd	Additive / interactive	Overlapping pathways and combined environmental exposure
Pb + Ca ⁺ , Fe	Antagonistic / modifying	Ca ⁺ and Fe can influence Pb absorption
Pb + As	Additive / mixture	Combined exposure may contribute to greater overall biological burden
Se + MeHg	Antagonistic / modifying	Se may influence the biological effects of Hg
Fe + Mn	Antagonistic / modifying	Fe may interfere with Mn absorption
Zn + Cu, Hg, Cd	Antagonistic / modifying	Bi-directional modification effect
Al + Fl	Antagonistic	Complexes can form and have been investigated for potential biological effects

"Big 4" Toxic Metals: Storage, and Clinical Impact

TOXIC ELEMENT	PRIMARY STORAGE	TESTING OPTIONS	KEY ELEMENTAL REACTIONS
Pb	Bone, Hair	Whole blood Current exposure 	Can depress Zn , Ca⁺ and disrupts Fe/Heme ; Pb is released during bone turnover; ferrochelatase is inhibited, causing increased protoporphyrins that can bind to Zn
Cd	Kidneys	24 hr Urine Chronic environmental, occupational exposure 	Shares transporters with: Zn ; Cu , Fe , Ca⁺ ; very long half-life (10–30 years)
As	Hair, Tissues	Fractionated Urine (all forms) Hair (mainly inorganic form)  	Can interfere with Se utilization and selenoprotein function; methylation
Hg	Brain, hair	Whole blood, Hair (80-90% MeHg), Urine   	Binds S ; binds directly to selenoproteins; inhibiting enzymes can create a functional Se deficiency

Hair Collection



- 🌱 Document hair treatments and shampoo use (especially selenium-containing dandruff shampoos) on the requisition form
- 🌱 Collect ~0.25 g untreated hair from the **posterior vertex**, cut as close to the scalp as possible. **Proximal 1 inch***
- 🌱 If scalp hair is unavailable, collect:
 - 🌱 Pubic, beard or chest hair (but do not mix collection sites)
 - 🌱 Fingernails or toenails are acceptable alternatives†
- 🌱 Animal hair can be processed - human reference ranges do not apply

* Hair growth rates vary among individuals; pediatric rate is slower.

† Nail specimens are interpreted using specimen-specific reference criteria. Additional fee required.

Lab Processing and Quality Considerations



1. Washing to remove external contaminants

The importance of cleaning of external contamination of hair and nail samples is of importance for validity of results and for interpreting data.” — U.S. EPA

2. Chemical Digestion

- 🔍 Fully liberate elements from the hair matrix
- 🔍 Minimize sample loss
- 🔍 Maintain accuracy and reproducibility

3. Triple quadrupole ICP-MS (ICP-MS/MS) technology:

- 🔍 Gold standard for trace element analysis
- 🔍 Older technologies (ICP-OES, AA, IC, ISE, colorimetric) have important limitations
- 🔍 Rigorous contamination control throughout analysis

Reference Ranges

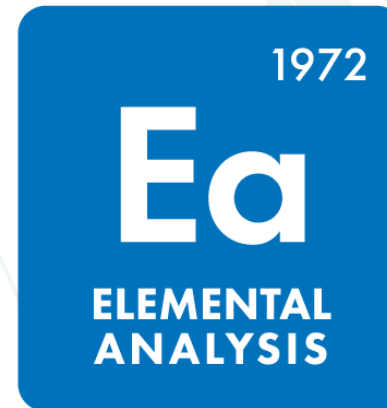


- Reference ranges are adjusted for **specimen type, age, and sex**
- **Doctor's Data patient database** (typically ~2,000 specimens)
 - Stratified by **age, sex, and specimen type**
 - - Review of data to exclude **potential contamination** and non-representative populations
- Ongoing review of **peer-reviewed scientific literature**
- Comparison with **other accredited laboratories** performing hair elemental analysis
- Benchmarking against population data, including **NHANES** and other healthy population studies

Reviewing the Hair Toxic & Essential Elements Profile



Hair Elements



Test Turnaround Time: 2 to 4 days after sample receipt

Big 4

Environment,
Soil, Water

New
Elements

Collection,
hair
treatments

Ratios

Toxic Rep.

Analyte		Result	Unit	Percentile		Reference Interval
				68 th	95 th	
Arsenic*	(As)	0.31	µg/g			<0.03
Lead*	(Pb)	16	µg/g			<0.2
Mercury*	(Hg)	0.70	µg/g			<0.3
Cadmium*	(Cd)	0.29	µg/g			<0.01
Thallium*	(Tl)	<0.0004	µg/g			<0.0006
Thorium*	(Th)	0.0006	µg/g			<0.0005
Antimony*	(Sb)	0.3	µg/g			<0.02
Beryllium*	(Be)	<0.0003	µg/g			<0.0004
Barium*	(Ba)	0.12	µg/g			<2
Uranium*	(U)	2.7	µg/g			<0.03
Bismuth*	(Bi)	0.033	µg/g			<0.06
Palladium*	(Pd)	<0.0006	µg/g			<0.0015
Platinum*	(Pt)	<0.0002	µg/g			<0.0005
Tungsten*	(W)	0.001	µg/g			<0.002
Cesium*	(Cs)	0.0002	µg/g			<0.0005
Gold*	(Au)	0.013	µg/g			≤0.01
Gadolinium*	(Gd)	<0.0002	µg/g			<0.0005
Tellurium*	(Te)	<0.015	µg/g			<0.020
Aluminum*	(Al)	7.0	µg/g			<5
Nickel*	(Ni)	0.23	µg/g			<0.3
Silver*	(Ag)	7.0	µg/g			<0.08
Tin*	(Sn)	0.33	µg/g			<0.2
Titanium*	(Ti)	0.02	µg/g			<0.2
Zn/Cd	(Ratio)	30000				≥2400
Ca/Pb	(Ratio)	2880				≥300
Se/Hg	(Ratio)	1				≥0.3
Total Toxic Representation						



Toxic Elements

High: *As, Pb*

Slightly Elevated: *Cd, U*

- Water source

Slightly Elevated: (M)Hg

- Fish/seafood product source (food, fish oil)

Slightly Elevated: *Al, Ni*

High: *Total Toxic Representation*

Investigating Potential Toxic Exposure Sources

TOXIC ELEMENT	COMMON EXPOSURES
Lead	Water , imported spices & herbal supplements, ceramics/antique dishes, Industrial sources, cigarette/ marijuana smoking and vaping, unregulated nutraceuticals/supps (bone collagen, protein powder, etc.)
Cadmium	Water , cigarettes, vaping, marijuana, rice, leafy vegetables, soy, shellfish, industrial exposure
Arsenic	Water , insecticides, wine, seafood, kelp, mushrooms, rice and rice products, chicken, apples, pesticides
Mercury	Water , seafood, amalgams (inorganic Hg), environmental and occupational exposure, cosmetics, medical treatments, fall out from coal fired power plants
Aluminum	Water , anti-perspirant, jet fuel, antacids, tin foil, cookware, shredded cheese, supplement desiccant in supplements, table salt, protein powder
Antimony	Tobacco, vaping, flame retardants (textiles, furniture, mattress, clothes), gun powder
Titanium	Make-up, lipstick, sunscreens, joint, dental implants
Uranium	Water , mining, coal combustion, phosphate fertilizers

Water as a Potential Exposure Source

Test your water for contaminants that can affect your family's health.

Many of the toxic elements people are exposed to can be found in our drinking water. For example:



Lead from out-of-date plumbing systems can contribute to serious health problems.



Metals such as arsenic, mercury, copper and uranium are regulated by the EPA due to known health effects.



Fluoride, which may be added to water to promote strong teeth, can be damaging at high levels.

That's why, in addition to providing clinical laboratory testing for physicians, Doctor's Data offers drinking water analysis to screen for potential issues in your home. We test for 17 elements, plus the pH level to determine whether your water may be causing lead, copper and other metals to leach out of pipes.

This information can provide peace of mind or help guide decisions about enhancing filtration, upgrading plumbing or drinking water from another source.

17 metals plus fluoride and pH — just \$129.



Who should have their water tested?

If you have concerns about your health or water, drinking water analysis can point to answers and provide peace of mind. If you rely on well water, you live in an older home or community, or your area has had problems with water in the past, it may be worth checking.

Doesn't my town test the water for me?

Municipalities are required to test drinking water and may provide an analysis upon request. However, this will not provide any insight on whether the water is contaminated after it leaves the treatment plant. If your water is acidic, for example, it may leach metals from the pipes on its way into your home.

How long does the analysis take?

You will receive an easy-to-read report, highlighting unacceptable levels of specific contaminants, within two weeks of submitting your water sample.

For more information, visit doctorsdata.com.



3755 Winola Avenue • St. Charles, IL 60174-2420
800.223.2784 • doctorsdata.com
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DRINKING WATER ANALYSIS



How clean is your drinking water?

Test 17 key contaminants, fluoride and pH. Just \$129.

COMPREHENSIVE DRINKING WATER ANALYSIS

WATER TYPE: Municipal
ORDERED BY: Doctor's Data, Inc.
 3755 Illinois Ave.
 St. Charles, IL USA

LAB NUMBER: W000000-0000-0
DATE ORDERED: 11/20/2012
DATE COLLECTED: 11/30/2012
DATE COMPLETED: 12/19/2012

PRIMARY EPA DRINKING WATER METALS

PRIMARY METALS	RESULT parts per billion (ppb)	ACCEPTABLE	CAUTION	UNACCEPTABLE
Arsenic (As)	1.6		X	
Copper (Cu)	28	X		
Lead (Pb)	16		X	
Thallium (Tl)	0.1	X		
Uranium (U238)	< 1	X		
Antimony (Sb)	< 0.5	X		
Barium	46	X		
Beryllium	< 0.4	X		
Cadmium (Cd)	< 1	X		
Chromium (Cr)	< 10	X		
Mercury (Hg)	< 0.5	X		
Nickel (Ni)	< 5	X		
Selenium (Se)	< 10	X		

The EPA has not established levels for this category

SECONDARY EPA DRINKING WATER METALS

SECONDARY METALS	RESULT parts per billion (ppb)	ACCEPTABLE	CAUTION	UNACCEPTABLE
Aluminum (Al)	170		X	
Iron (Fe)	72	X		
Manganese (Mn)	< 5	X		
Zinc (Zn)	< 50	X		

The EPA has not established levels for this category

FLUORIDE

	RESULT parts per million (ppm)	ACCEPTABLE	CAUTION	UNACCEPTABLE
Fluoride (F ⁻)	0.2	X		

The EPA has not established levels for this category

Fluoride is naturally occurring and is sometimes added to water to promote strong teeth. High levels can cause bone disease and mottled teeth. Although controversial, some researchers report adverse health affects at levels lower than "acceptable" by the EPA.

pH LEVEL

	RESULT pH unit	ACIDIC < 6.5	ACCEPTABLE 6.5 - 8.5	ALKALINE > 8.5
pH	7.9		X	

info@doctorsdata.com for pricing and patient brochures

*Not available in FL, NY, CT

Analyte		Result	Unit	Percentile					Reference Interval
				2.5 th	16 th	Mean	84 th	97.5 th	
Calcium*	(Ca)	144	µg/g						300 – 1200
Magnesium*	(Mg)	30	µg/g						35 – 120
Sodium*	(Na)	8	µg/g						15 – 120
Potassium*	(K)	2	µg/g						3 – 50
Copper*	(Cu)	8.0	µg/g						11 – 30
Zinc*	(Zn)	150	µg/g						170 – 240
Manganese*	(Mn)	0.42	µg/g						0.06 – 0.50
Chromium*	(Cr)	0.07	µg/g						0.03 – 0.2
Vanadium*	(V)	0.0030	µg/g						0.002 – 0.04
Molybdenum*	(Mo)	0.58	µg/g						0.02 – 0.04
Boron*	(B)	0.82	µg/g						0.2 – 1
Iodine*	(I)	27	µg/g						0.25 – 1.8
Lithium*	(Li)	0.020	µg/g						0.003 – 0.020
Phosphorus*	(P)	77	µg/g						100 – 140
Selenium*	(Se)	0.71	µg/g						0.4 – 0.7
Strontium*	(Sr)	1.3	µg/g						0.50 – 7.6
Sulfur*	(S)	45800	µg/g						44000 – 50000
Cobalt*	(Co)	0.0099	µg/g						0.003 – 0.04
Iron*	(Fe)	5.9	µg/g						6 – 15
Rubidium*	(Rb)	0.0050	µg/g						0.004 – 0.04
Ca/Mg	(Ratio)	4.8							6 – 16
Ca/P	(Ratio)	1.87							2 – 12
Na/K	(Ratio)	4.00							0.8 – 10
Zn/Cu	(Ratio)	18.8							8 – 21

**Single marker hair or urine testing available upon request.*



Essential Elements

Provides retrospective time-averaged assessment as a valuable screening tool

Confirmation testing:

- Ca, Na, K, P: Whole blood (CBC)
- Cu: Ceruloplasmin, serum Cu
- Zn, Mg: RBC
- Fe: Iron blood panel
- I: Pre/Post Load Urine, Halides



Essential Elements and GI Considerations

↓ Ca⁺, Na⁺, K, P, Zn, Mn, Mo:
Confirm in bloodwork

↓ Cu: Confirm in ceruloplasmin
and serum Cu

↓ Zn, Mg²⁺: Confirm in RBC

Analyte	Result	Unit	2.5 th	16 th	Mean	84 th	97.5 th	Reference Interval
Calcium* (Ca)	144	µg/g						300 – 1200
Magnesium* (Mg)	30	µg/g						35 – 120
Sodium* (Na)	8	µg/g						15 – 120
Potassium* (K)	2	µg/g						3 – 50
Copper* (Cu)	8.0	µg/g						11 – 30
Zinc* (Zn)	150	µg/g						170 – 240
Manganese* (Mn)	0.42	µg/g						0.06 – 0.50
Chromium* (Cr)	0.07	µg/g						0.03 – 0.2
Vanadium* (V)	0.0030	µg/g						0.002 – 0.04
Molybdenum* (Mo)	0.58	µg/g						0.02 – 0.04
Boron* (B)	0.82	µg/g						0.2 – 1
Iodine* (I)	27	µg/g						0.25 – 1.8
Lithium (Li)	0.020	µg/g						0.005 – 0.020
Phosphorus* (P)	77	µg/g						100 – 140
Selenium* (Se)	0.71	µg/g						0.4 – 0.7
Strontium* (Sr)	1.3	µg/g						0.50 – 7.6
Sulfur* (S)	45800	µg/g						44000 – 50000
Cobalt* (Co)	0.0099	µg/g						0.003 – 0.04
Iron* (Fe)	5.9	µg/g						6 – 15
Rubidium* (Rb)	0.0050	µg/g						0.004 – 0.04
Ca/Mg (Ratio)	4.8							6 – 16
Ca/P (Ratio)	1.87							2 – 12
Na/K (Ratio)	4.00							0.8 – 10
Zn/Cu (Ratio)	18.8							8 – 21



Essential + Toxic Element Relationships

Analyte		Result	Unit	Percentile					Reference Interval
				2.5th	10th	Mean	84th	97.5th	
Calcium*	(Ca)	144	µg/g						300–1200
Magnesium*	(Mg)	30	µg/g						35–120
Sodium*	(Na)	8	µg/g						15–120
Potassium*	(K)	2	µg/g						3–50
Copper*	(Cu)	8.0	µg/g						11–30
Zinc*	(Zn)	150	µg/g						170–240
Manganese*	(Mn)	0.42	µg/g						0.08–0.50
Chromium*	(Cr)	0.07	µg/g						0.03–0.2
Vanadium*	(V)	0.0030	µg/g						0.002–0.04
Molybdenum*	(Mo)	0.58	µg/g						0.02–0.04
Boron*	(B)	0.82	µg/g						0.2–1
Iodine*	(I)	27	µg/g						0.25–1.8
Lithium*	(Li)	0.020	µg/g						0.003–0.020
Phosphorus*	(P)	77	µg/g						100–140
Selenium*	(Se)	0.71	µg/g						0.4–0.7
Strontium*	(Sr)	1.3	µg/g						0.50–7.8
Sulfur*	(S)	45800	µg/g						44000–50000
Cobalt*	(Co)	0.0099	µg/g						0.003–0.04
Iron*	(Fe)	5.9	µg/g						6–15
Rubidium*	(Rb)	0.0050	µg/g						0.004–0.04
Ca/Mg	(Ratio)	4.8							6–16
Ca/P	(Ratio)	1.87							2–12
Na/K	(Ratio)	4.00							0.8–10
Zn/Cu	(Ratio)	18.8							8–21

Blood Sugar / Insulin Resistance
Research Relationships:

↑ Ca:Mg,
↑ Cu, ↓ Se

↓ Cr, B
↑ Pb, As

Thyroid Pattern Elemental
Relationships:
I + Se + Toxic elements

Calcium–Phosphorus Regulation:

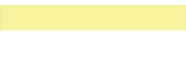
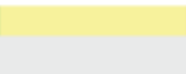
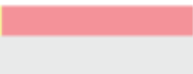
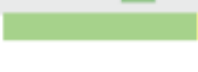
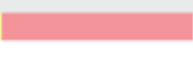
↑ Ca+, ↓ P

Additional context: Mg, vitamin D,
PTH, and potentially B

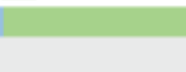
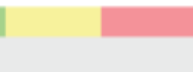
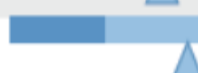
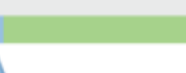
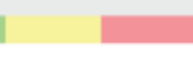
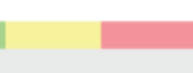
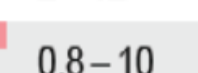
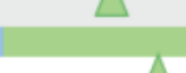
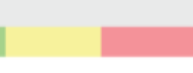
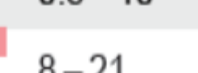
Understanding Elemental Ratios for Additional Context



Toxic Metals : Essential Elements

Zn/Cd	(Ratio)	30000				≥ 2400
Ca/Pb	(Ratio)	2880				≥ 300
Se/Hg	(Ratio)	1				≥ 0.3

Essential Elements : Essential Elements

Ca/Mg	(Ratio)	4.8					6 – 16
Ca/P	(Ratio)	1.87					2 – 12
Na/K	(Ratio)	4.00					0.8 – 10
Zn/Cu	(Ratio)	18.8					8 – 21

DDI Complementary Testing: Following the Clinical Hypothesis

GI Malabsorption pattern:



GI360; stool



Comprehensive Stool Analysis
+ Parasitology

Blood Sugar/Insulin/Adrenal pattern:



Comprehensive Adrenal
Function Profile; saliva



NeuroAdrenal Profile; saliva &
urine

Iodine pattern:



Urine Halides Pre & Post
Load



Urine Iodine Pre & Post Load

Hair Testing: Its Role in Elemental Assessment



- 🌱 **Exposure screening:** May help identify potential elemental exposure patterns.
- 🌱 **Longer-term perspective:** Provides insight into elemental exposure over time.
- 🌱 **Broad elemental assessment:** Measures multiple toxic and essential elements from a single sample.
- 🌱 **Complementary information:** Supplements blood and urine testing when interpreted in context.
- 🌱 **Noninvasive, easy collection and transport:** Painless and convenient; no blood draw required; stable specimen with convenient handling.
- 🌱 **Retesting:** 3-6 months after clinical intervention, food or lifestyle change.

Looking Ahead: Connecting the Clinical Picture



- 🔗 **Integrating complex exposure data:** Diet, occupation, environment, products, and lifestyle
- 🔗 **Pattern recognition:** Identifying combinations of factors associated with elemental exposure
- 🔗 **Exposure hypothesis generation:** Helping identify potential sources for further investigation
- 🔗 **Clinical context:** Combining laboratory findings with a more comprehensive exposure history



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THANK YOU

QUESTIONS?

