

Toxic and Essential Elements



Assessment of Key Minerals and Harmful Metals

- Whole Blood, Red Blood Cell and Serum Elements
- Urine Toxic and Essential Elements
- Hair Elements
- Stool Toxic Metals



SCIENCE + INSIGHT

Toxic and Essential Elements

Elements are the basic building blocks of all chemical compounds, and human exposure to them occurs both from natural and anthropogenic sources. Many elements are considered nutrients and are essential for the proper functioning of the body. These are generally divided between macrominerals such as calcium, magnesium, potassium, sodium and zinc, and trace minerals including selenium, iodine, boron and molybdenum.

Conversely, there are a number of elements that are toxic to the human body, interfere with its functioning and undermine health—such as mercury, lead, cadmium, aluminum, and arsenic. These toxic metals have no known physiological functions. They can be toxic to organ systems and may disrupt the balance of essential nutrients. Toxic metals and essential element status can be assessed in urine, blood, feces and hair.

Doctor's Data has always employed the best-available techniques as a specialist and pioneer in essential and toxic elemental testing. In fact, we were one of the first clinical reference laboratories in the world to employ ICP-MS and high-resolution ICP-MS for elemental analysis.

Deficiencies of essential trace elements or excessive amounts of

heavy metals in the human body

can cause significant health effects.

Comprehensive Blood Elements



The standard for diagnosis of lead, mercury or other metal toxicity, whole blood metals are also used to assess recent or ongoing exposure to potentially toxic elements. Red blood

cell (RBC) elements tests are used to assess the status of essential elements with important intracellular functions, such as magnesium, copper and zinc. Serum elements are used to assess the

status of key elements and electrolytes. Deficiencies or excesses of these essential elements affect numerous metabolic processes.

LAB #: Sample Report
 PATIENT: Sample Patient
 ID:
 SEX: Female
 AGE: 24

CLIENT #: 12345
 DOCTOR: Sample Doctor
 Doctor's Data, Inc.
 3755 Illinois Ave.
 St. Charles, IL 60174 U.S.A.

Essential Elements; Serum

Calcium (Ca)
Magnesium (Mg)
Sodium (Na)
Potassium (K)
Phosphorus (P)
Iron (Fe)

Sodium and Potassium
 Sodium (Na⁺) and potassium (K⁺) are electrolytes that regulate the hydration of various body fluid compartments. Both are involved in oxidation-reduction reactions and participate in nerve impulses. Hemolysis can result in falsely elevated K⁺.

Magnesium
 Magnesium (Mg) is a major intracellular cation. It is involved in about the factors affecting serum Mg, but also in the regulation of parathyroid hormone, diabetes, hypertension, alcoholism and diuresis. Increased serum Mg can result in Addison's disease.

Calcium
 Although 99% of calcium exists in bones, it is essential for nerve impulses, muscle contraction, coagulation, and is regulated by parathyroid hormone, and serum calcium levels result in muscle tetany while high Ca levels result in muscle weakness. Marked variations in serum Ca may result in kidney disease, and other abnormalities.

Inorganic Phosphorus
 Measurements of serum inorganic phosphorus are used to assess parathyroid gland and kidney diseases, and parathyroid hormone, and PO₄ levels are in muscle weakness, while elevated PO₄ may result in muscle weakness.

Iron
 Measurements of non-heme, serum iron (Fe) are used to assess toxicity and acute or chronic hemochromatosis and ferritin.

Comments:

Date Collected: 02/19/2022
 Date Received: 02/21/2022
 Date Completed: 02/22/2022

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LAB #: B000000-0000-0
 PATIENT: Sample Patient
 ID: PATIENT-S-00000
 SEX: Female
 DOB:
 AGE: 46

CLIENT #: 12345
 DOCTOR:
 Doctor's Data, Inc.
 3755 Illinois Ave.
 St. Charles, IL 60174 U.S.A.

Toxic & Essential Elements; Whole Blood

Calcium (Ca)
Magnesium (Mg)
Copper (Cu)
Zinc (Zn)
Manganese (Mn)
Chromium (Cr)
Lithium (Li)
Selenium (Se)
Strontium (Sr)
Molybdenum (Mo)
Vanadium (V)
Arsenic (As)
Barium (Ba)
Cadmium (Cd)
Cobalt (Co)
Lead (Pb)
Mercury (Hg)
Nickel (Ni)
Platinum (Pt)
Thallium (Tl)
Tungsten (W)
Uranium (U)

Comments:

Date Collected: 01/04/2022
 Date Received: 01/05/2022
 Date Reported: 01/07/2022
 Blood lead levels in the range of 5-9 µg/dL has been reported.

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LAB #: B000000-0000-0
 PATIENT: Sample Patient
 ID: PATIENT-S-00000
 SEX: Female
 DOB:
 AGE: 71

CLIENT #: 12345
 DOCTOR:
 Doctor's Data, Inc.
 3755 Illinois Ave.
 St. Charles, IL 60174 U.S.A.

Toxic & Essential Elements; Packed Red Blood Cells

ESSENTIAL AND OTHER ELEMENTS		RESULT / UNIT	REFERENCE INTERVAL	PERCENTILE				
				2.5 th	16 th	50 th	84 th	97.5 th
Calcium (Ca)	15	µg/g	8-26					
Magnesium (Mg)	37	µg/g	39-59					
Potassium (K)	86	mEq/L	78-97					
Phosphorus (P)	578	µg/g	520-670					
Copper (Cu)	0.586	µg/g	0.52-0.8					
Zinc (Zn)	8.0	µg/g	7.8-13.8					
Iron (Fe)	917	µg/g	800-1010					
Manganese (Mn)	0.030	µg/g	0.009-0.033					
Selenium (Se)	0.170	µg/g	0.16-0.49					
Boron (B)	0.101	µg/g	0.01-0.11					
Molybdenum (Mo)	0.0006	µg/g	0.0002-0.001					

TOXIC METALS		RESULT / UNIT	REFERENCE INTERVAL	PERCENTILE	
				95 th	99 th
Arsenic (As)	0.0048	µg/g	< 0.008		
Cadmium (Cd)	0.0013	µg/g	< 0.002		
Cesium (Cs)	0.0070	µg/g	< 0.015		
Chromium (Cr)	0.0013	µg/g	< 0.0005		
Lead (Pb)	0.043	µg/g	< 0.05		
Mercury (Hg)	0.0097	µg/g	< 0.01		
Thallium (Tl)	0.00007	µg/g	< 0.00005		

Comments:

Date Collected: 03/30/2017
 Date Received: 04/03/2017
 Date Reported: 04/06/2017

Methodology: LC-MS/MS

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Results are presented in a clear, easy-to-understand report which details target ranges and graphically illustrates areas of concern. Result-specific commentary is also provided.

Urine Toxic and Essential Elements



Urine Elements are traditionally used to evaluate exposure to potentially toxic elements and wasting of nutrient elements. Toxic metals do not have any useful physiological function. Instead, they adversely affect virtually every organ system and disrupt the homeostasis of nutrient elements.

Additionally, the comparison of urine element concentrations before and after administration of a chelator can be used to estimate net retention of potentially toxic elements. Subsequent urine element analyses, also following the administration of a chelator, are useful for monitoring the efficacy of

metal detoxification therapy. Results are expressed per 24 hours or creatinine corrected to account for urine dilution effects.

Essential Elements; urine

Order: 999999-9999

Test: X999999-9999-1
Client #: 999999
Doctor: Sample Doctor, MD
 Doctors Data Inc
 123 Main St.
 St. Charles, IL 60174 USA

Patient: Sample
Id: 999999
Age: 55 **DOB:** 0
Sex: Female

Essential Elements	Result	Unit
Sodium	121	mEq/g
Potassium	63.1	mEq/g
Phosphorus	825	µg/mg
Calcium	292	µg/mg
Magnesium	213	µg/mg
Zinc	2.8	µg/mg
Copper	0.391	µg/mg
Sulfur	1190	µg/mg
Molybdenum	0.0279	µg/mg
Boron	4.0	µg/mg
Lithium	0.0321	µg/mg
Selenium	0.072	µg/mg
Strontium	0.413	µg/mg
Cobalt	0.50	µg/g
Iron	12	µg/g
Manganese	1.1	µg/g
Chromium	1.2	µg/g
Vanadium	0.50	µg/g
Urine Creatinine	36.7	mg/dL

Notes:
 < dl: less than detection limit
 Results are creatinine corrected to account for urine dilution variations. **Reference intervals are representative of a large population cohort under non-provoked conditions.**
 Methodology: ISE, Spectrophotometry, ICP-MS QQQ, Creatinine by Jaffe Reaction
Page: 2 of 12

Toxic Metals; urine

Order: 999999-9999

Test: X999999-9999-1
Client #: 999999
Doctor: Sample Doctor, MD
 Doctors Data Inc
 123 Main St.
 St. Charles, IL 60174 USA

Patient: Sample Patient
Id: 999999
Age: 55 **DOB:** 01/02/1967
Sex: Female

Sample Collection Date: 09/27/2022
Collection Period: 6 hr
Date Received: 10/01/2022
Date Reported: 10/04/2022

Toxic Metals	Result	Unit	Within Reference	Outside Reference	Reference Interval
Aluminum	12	µg/g	▲		< 25
Antimony	0.28	µg/g		▲	< 0.18
Arsenic	29	µg/g	▲		< 50
Barium	7.3	µg/g		▲	< 5
Beryllium	<dl	µg/g		▲	< 0.01
Bismuth	0.095	µg/g	▲		< 1
Cadmium	0.36	µg/g	▲		< 0.9
Cesium	8.5	µg/g	▲		< 10
Gadolinium	0.13	µg/g	▲		< 0.8
Lead	8.8	µg/g		▲	< 1.2
Mercury	31	µg/g		▲	< 1.3
Nickel	1.6	µg/g	▲		< 5
Palladium	0.15	µg/g	▲		< 0.3
Platinum	<dl	µg/g		▲	< 0.1
Tellurium	<dl	µg/g	▲		< 0.5
Thallium	0.64	µg/g		▲	< 0.5
Thorium	0.056	µg/g		▲	< 0.02
Tin	6.5	µg/g		▲	< 5
Tungsten	0.13	µg/g	▲		< 0.4
Uranium	0.069	µg/g		▲	< 0.03
Urine Creatinine	36.7	mg/dL		▲	80 - 177

Notes:
 < dl: less than detection limit
 Results are creatinine corrected to account for urine dilution variations. **Reference intervals are based upon NHANES (cdc.gov/nhanes) data if available, and are representative of a large population cohort under non-provoked conditions.** Chelation (provocation) agents can increase urinary excretion of metals/elements.
 Methodology: ICP-MS QQQ, Creatinine by Jaffe Reaction
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Hair Elements



Hair Elements analysis provides information regarding recent and ongoing exposure to potentially toxic metals, especially methylmercury and arsenic, and time-averaged status of specific nutrient elements. This noninvasive screening test requires only .25 grams of hair. Doctor's Data offers a Hair Elements profile containing essential and toxic elements and a Hair Toxic Element Exposure profile containing an expanded lineup of toxic metals.

A specialist and pioneer in essential and toxic elemental testing since 1972, Doctor's Data has been validated as a supplier of trace element results for the certification of a hair reference material to the European Commission Joint Research Centre.



LAB #: Sample Report
 PATIENT: Sample Patient
 ID:
 SEX: Male
 AGE: 57

CLIENT #: 12345
 DOCTOR: Sample Doctor
 Doctor's Data, Inc.
 3755 Illinois Ave.
 St. Charles, IL 60174 U.S.A.

Toxic Element Exposure Profile; Hair

TOXIC METALS				PERCENTILE	
	RESULT µg/g	REFERENCE INTERVAL	68 th	95 th	
Arsenic (As)	0.096	< 0.20			
Lead (Pb)	31	< 5.0			
Mercury (Hg)	3.9	< 3.0			
Cadmium (Cd)	0.18	< 0.30			
Chromium (Cr)	0.40	< 0.95			
Beryllium (Be)	< 0.01	< 0.050			
Cobalt (Co)	0.013	< 0.080			



LAB #: Sample Report
 PATIENT: Sample Patient
 ID:
 SEX: Male
 AGE: 5

CLIENT #: 12345
 DOCTOR: Sample Doctor
 Doctor's Data, Inc.
 3755 Illinois Ave.
 St. Charles, IL 60174 U.S.A.

Toxic & Essential Elements; Hair

TOXIC METALS				PERCENTILE	
	RESULT µg/g	REFERENCE INTERVAL	68 th	95 th	
Aluminum (Al)	17	< 8.0			
Antimony (Sb)	0.096	< 0.066			
Arsenic (As)	0.27	< 0.080			
Barium (Ba)	0.39	< 0.50			
Beryllium (Be)	< 0.01	< 0.020			
Bismuth (Bi)	0.033	< 2.0			
Cadmium (Cd)	0.054	< 0.070			
Lead (Pb)	4.6	< 1.0			
Mercury (Hg)	0.38	< 0.40			
Platinum (Pt)	< 0.003	< 0.005			
Thallium (Tl)	0.001	< 0.002			
Thorium (Th)	0.001	< 0.002			
Uranium (U)	0.58	< 0.060			
Nickel (Ni)	0.17	< 0.20			
Silver (Ag)	0.23	< 0.20			
Tin (Sn)	0.29	< 0.30			
Titanium (Ti)	0.71	< 1.0			
Total Toxic Representation					

ESSENTIAL AND OTHER ELEMENTS				PERCENTILE				
	RESULT µg/g	REFERENCE INTERVAL	2.5 th	16 th	50 th	84 th	97.5 th	
Calcium (Ca)	920	125- 370						
Magnesium (Mg)	230	12- 30						
Sodium (Na)	64	20- 200						
Potassium (K)	31	12- 200						
Copper (Cu)	30	11- 18						
Zinc (Zn)	86	100- 190						
Manganese (Mn)	1.4	0.10- 0.50						
Chromium (Cr)	0.59	0.43- 0.80						
Vanadium (V)	0.28	0.030- 0.10						
Molybdenum (Mo)	0.15	0.050- 0.13						
Boron (B)	8.6	0.70- 5.0						
Iodine (I)	2.4	0.25- 1.3						
Lithium (Li)	0.045	0.007- 0.020						
Phosphorus (P)	200	150- 220						
Selenium (Se)	0.63	0.70- 1.1						
Strontium (Sr)	7.5	0.16- 1.0						
Sulfur (S)	46300	45500- 53000						
Cobalt (Co)	0.035	0.004- 0.020						
Iron (Fe)	19	7.0- 16						
Germanium (Ge)	0.034	0.030- 0.040						
Rubidium (Rb)	0.058	0.016- 0.18						
Zirconium (Zr)	0.61	0.040- 1.0						

COMMENTS:		RATIOS		
		ELEMENTS	RATIOS	RANGE
Date Collected: 01/02/2022	Sample Size: 0.197 g	Ca/Mg	4	4- 30
Date Received: 01/10/2022	Sample Type: Head	Ca/P	4.6	0.8- 8
Date Completed: 01/11/2022	Hair Color:	Na/K	2.06	0.5- 10
Methodology: ICP/MS	Treatment:	Zn/Cu	2.87	4- 20
	Shampoo: Neutro	Zn/Cd	> 999	> 800

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0001544

Stool Toxic Metals



Analysis of elements in stool provides a means to assess oral exposure, and to a lesser extent endogenous detoxification of potentially toxic metals. For several toxic elements such as mercury, cadmium, lead, antimony and uranium, biliary excretion of metals into feces is a primary natural route of elimination from the body. Specimen collection is convenient for the patient and only requires a single-step procedure. Elements are measured by ICP-MS and expressed on a dry weight basis to eliminate variability related to water content of the specimen.

Specimen collection is convenient for the patient and requires only a single-step procedure. Results are presented in a clear, easy-to-understand report and includes result-specific commentary.

Toxic Metals; stool

DOCTOR'S DATA Inc.

Order: SAMPLE REPORT Client #: 12345 Doctor: Sample Doctor Doctor's Data, Inc. 3755 Illinois Ave. St. Charles, IL 60174	Patient: Sample Patient Age: 35 Sex: Female Dental Amalgams: Yes	Sample Collection Date Collected 02/21/2022 Date Received 02/22/2022 Date Reported 02/23/2022
---	---	--

Toxic Metals	Result	Unit	Percentile 68 th 95 th	Reference Interval
Antimony	0.056	mg/kg Dry Wt		<0.050
Arsenic	0.08	mg/kg Dry Wt		<0.20
Beryllium	0.005	mg/kg Dry Wt		<0.011
Bismuth	0.053	mg/kg Dry Wt		<0.100
Cadmium	0.50	mg/kg Dry Wt		<0.50
Cesium	0.25	mg/kg Dry Wt		<0.1
Copper	52	mg/kg Dry Wt		<60
Gadolinium	0.14	mg/kg Dry Wt		<0.03
Lead	0.29	mg/kg Dry Wt		<0.30
Manganese	121	mg/kg Dry Wt		<200
Mercury	0.41	mg/kg Dry Wt		<0.050
Nickel	9.1	mg/kg Dry Wt		<8.0
Platinum	<dl	mg/kg Dry Wt		<0.003
Thallium	0.60	mg/kg Dry Wt		<0.020
Tungsten	0.015	mg/kg Dry Wt		<0.130
Uranium	0.19	mg/kg Dry Wt		<0.100

Water Content	Result	Unit	-2SD -1SD Mean +1SD +2SD	Reference Interval
Water Content	74.1	%		66.3-78.8

Information

- Analysis of elements in feces provides a means to assess oral exposure, and to a lesser extent endogenous detoxification of potentially toxic metals. For several toxic elements such as mercury, cadmium, lead, antimony and uranium, biliary excretion of metals into feces is a primary natural route of elimination from the body. Studies performed at Doctor's Data demonstrate that the fecal mercury content and number of amalgam surfaces are highly correlated. Therefore people with several amalgams in place will typically have higher concentrations of fecal mercury than people without amalgams. Results are reported as mg/kg dry weight of feces to eliminate the influence of variability in water content of fecal specimens. To provide guidance in interpretation of results, patient values are plotted graphically with respect to percentile distribution of the population base. Since this test reflects both oral exposure and biliary excretion of metals, overt clinical associations are not directly implied.
- Cesium High**
Fecal cesium (CS) provides an indication of recent oral exposure to the element, and to a much lesser extent Cs that has been excreted from the body in bile.

Notes:
 Methodology: ICP-MS
 Page: 1 of 3 Analyzed by DOCTOR'S DATA, INC. • 3755 Illinois Avenue, St. Charles, IL 60174-2420 USA • LAB DIR: Eric Roth, MD • CLIA ID: 14D0646470

Compare Profiles

	Urine Toxic and Essential Elements	Urine Toxic Elements	Stool Toxic Metals	Hair Elements	Hair Toxic Elements	Comprehensive Blood Elements	Whole Blood Elements	Serum Elements	Red Blood Cell Elements
Aluminum	✓	✓		✓	✓				
Antimony	✓	✓	✓	✓	✓				
Arsenic	✓	✓	✓	✓	✓	✓	✓		✓
Barium	✓	✓		✓	✓	✓	✓		
Beryllium	✓	✓	✓	✓	✓				
Bismuth	✓	✓	✓	✓	✓				
Boron	✓			✓					✓
Cadmium	✓	✓	✓	✓	✓	✓	✓		✓
Calcium	✓			✓		✓	✓	✓	✓
Cesium	✓	✓			✓				✓
Chromium	✓			✓	✓	✓	✓		✓
Cobalt	✓			✓	✓	✓	✓		
Copper	✓		✓	✓	✓	✓	✓		✓
Gadolinium	✓	✓			✓				
Germanium				✓	✓				
Gold					✓				
Iodine/Iodide				✓					
Iron	✓			✓		✓		✓	✓
Lead	✓	✓	✓	✓	✓	✓	✓		✓
Lithium	✓			✓		✓	✓		
Magnesium	✓			✓		✓	✓	✓	✓
Manganese	✓			✓	✓	✓	✓		✓
Mercury	✓	✓	✓	✓	✓	✓	✓		✓
Molybdenum	✓			✓		✓	✓		✓
Nickel	✓	✓	✓	✓	✓	✓	✓		
Palladium	✓	✓			✓				
Phosphorus	✓			✓		✓		✓	✓
Platinum	✓	✓	✓	✓	✓	✓	✓		
Potassium	✓			✓		✓		✓	✓
Rubidium				✓					
Selenium	✓			✓	✓	✓	✓		✓
Silver				✓	✓				
Sodium	✓			✓		✓		✓	
Strontium	✓			✓		✓	✓		
Sulfur	✓			✓					
Tellurium	✓	✓			✓				
Thallium	✓	✓	✓	✓	✓	✓	✓		✓
Thorium	✓	✓		✓	✓				
Tin	✓	✓		✓	✓				
Titanium				✓	✓				
Tungsten	✓	✓	✓		✓	✓	✓		
Uranium	✓	✓	✓	✓	✓	✓	✓		
Vanadium	✓			✓	✓	✓	✓		✓
Zinc	✓			✓	✓	✓	✓		✓
Zirconium				✓					

OUR MISSION:

To research, develop and offer innovative specialty tests that help doctors identify health risks and improve outcomes for patients with chronic conditions.

To educate and support healthcare professionals.

To improve lives through science.



SCIENCE + INSIGHT

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About Doctor's Data

Doctor's Data, Inc. has provided innovative specialty testing to healthcare practitioners around the world from our advanced, CLIA-licensed clinical laboratory since 1972.

As a pioneer in the laboratory testing industry, Doctor's Data provides a wide array of testing solutions to aid in decision making and better patient outcomes. Choose Doctor's Data to help you assess and treat heavy metal burden, nutritional deficiencies, gastrointestinal function, hormone status, cardiovascular risk, liver and metabolic abnormalities, and more.