DOCTOR'S DATA INC.

ORDER: SAMPLE REPORT
PATIENT: Sample Patient
ID:
SEX: Female
AGE: 35

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

Essential Elements; urine

ESSENTIAL ELEMENTS				
		RESULT mEq/g Creat	REFERENCE INTERVAL	PERCENTILE 2.5th 16th 50th 84th 97.5th
Sodium	(Na)	125	45 – 200	
Potassium	(K)	99.2	20 – 110	
		RESULT µg/mg Creat		
Phosphorus	(P)	611	180 – 1100	
Calcium	(Ca)	177	30 – 350	
Magnesium	(Mg)	241	25 – 230	
Zinc	(Zn)	0.32	0.1 – 1.5	
Copper	(Cu)	0.0072	0.006 – 0.026	
Sulfur	(S)	607	250 – 1050	
Molybdenum	(Mo)	0.0400	0.013 – 0.13	
Boron	(B)	5.1	0.6 – 4	
Lithium	(Li)	0.0498	0.009 – 0.2	
Selenium	(Se)	0.259	0.03 – 0.25	
Strontium	(Sr)	0.253	0.045 – 0.3	

		RESULT µg/g Creat	REFERENCE INTERVAL	68th 95th
Cobalt	(Co)	70	< 1.7	
Iron	(Fe)	<dl	< 50	
Manganese	(Mn)	<dl	< 0.6	
Chromium	(Cr)	98	< 2	
Vanadium	(V)	<dl	< 0.8	

URINE CREATININE			
	RESULT mg/dL	REFERENCE INTERVAL	-2SD -1SD MEAN +1SD +2SD
Creatinine	17.9	30 – 225	

SPECIMEN DATA

Comments:
Date Collected: 08/05/2020
Date Received: 08/06/2020
Date Reported: 08/07/2020
Collection Period: Random
Urine Volume: 1000 mL
Methodology: ISE, Spectrophotometry, ICP-MS QQQ, Creatinine by Jaffe Reaction

< 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.

Introduction

This analysis of urinary elements was performed by ICP-Mass Spectroscopy following acid digestion of the specimen. Urine element analysis is intended primarily for: diagnostic assessment of toxic element status, monitoring detoxification therapy, and identifying or quantifying renal wasting conditions. It is difficult and problematic to use urinary elements analysis to assess nutritional status or adequacy for essential elements. Blood, cell, and other elemental assimilation and retention parameters are better indicators of nutritional status.

- 24 Hour Collections
  "Essential and other" elements are reported as mg/24 h; mg element/urine volume (L) is equivalent to ppm. "Potentially Toxic Elements" are reported as µg/24 h; µg element/urine volume (L) is equivalent to ppb.
- Timed Samples (< 24 hour collections)
  All "Potentially Toxic Elements" are reported as µg/g creatinine; all other elements are reported as µg/mg creatinine. Normalization per creatinine reduces the potentially great margin of error which can be introduced by variation in the sample volume. It should be noted, however, that creatinine excretion can vary significantly within an individual over the course of a day.

If one intends to utilize urinary elements analysis to assess nutritional status or renal wasting of essential elements, it is recommended that unprovoked urine samples be collected for a complete 24 hour period. For provocation (challenge) tests for potentially toxic elements, shorter timed collections can be utilized, based upon the pharmacokinetics of the specific chelating agent. When using EDTA, DMPS or DMSA, urine collections up to 12 hours are sufficient to recover greater than 90% of the mobilized metals. Specifically, we recommend collection times of: 9 - 12 hours post intravenous EDTA, 6 hours post intravenous or oral DMPS and, 6 hours post oral bolus administration of DMSA. What ever collection time is selected by the physician, it is important to maintain consistency for subsequent testing for a given patient.

If an essential element is sufficiently abnormal per urine measurement, a descriptive text is included with the report. Because renal excretion is a minor route of excretion for some elements, (Cu, Fe, Mn Zn), urinary excretion may not influence or reflect body stores. Also, renal excretion for many elements reflects homeostasis and the loss of quantities that may be at higher dietary levels than is needed temporarily. For these reasons, descriptive texts are provided for specific elements when deviations are clinically significant. For potentially toxic elements, a descriptive text is provided whenever levels are measured to be higher than expected. If no descriptive texts follow this introduction, then all essential element levels are within acceptable range and all potentially toxic elements are within expected limits.

Reference intervals and corresponding graphs shown in this report are representative of a healthy population under non-provoked conditions. Descriptive texts appear in this report on the basis of measured results and correspond to non-challenge, non-provoked conditions.

Chelation (provocation) agents can increase urinary excretion of metals/elements. Provoked reference intervals have not been established therefore non-provoked reference intervals shown are not recommended for comparison purposes with provoked test results. Provoked results can be compared with non-provoked results (not reference intervals) to assess body burden of metals and to distinguish between transient exposure and net retention of metals. Provoked results can also be compared to previous provoked results to monitor therapies implemented by the treating physician. Additionally, Ca-EDTA provoked results can be used to calculate the EDTA/Lead Excretion Ratio (LER) in patients with elevated blood levels.

CAUTION: Even the most sensitive instruments have some detection limit below which a measurement cannot be made reliably. Any value below the method detection limit is simply reported as "< dl." If an individual excretes an abnormally high volume of urine, urinary components are likely to be extremely dilute. It is possible for an individual to excrete a relatively large amount of an element per day that is so diluted by the large urine volume that the value measured is near the dl. This cannot automatically be assumed to be within the reference range.

This analysis of urinary essential elements was performed by ICP-Mass Spectroscopy. Analysis of essential and other elements in urine is used primarily to identify and characterize renal wasting conditions. Analysis of essential elements in urine is not a direct approach for assessing nutritional status or adequacy. Blood, cell, and other assimilation and retention parameters are optimal direct indicators of essential element status.

If one intends to utilize urinary elements analysis to assess nutritional status or renal wasting of essential elements, it is recommended that unprovoked urine samples be collected for a complete 24 hour period. For 24 hour urine collections essential elements are reported as mg/24 h. For timed or first morning urine collections, elements are normalized per gram creatinine to avoid the potentially great margin of error which can be introduced by variation in the sample volume (concentration). It should be noted that creatinine excretion for an individual may vary to some extent over the course of a day, and from day to day.

If an essential element is sufficiently abnormal per urine measurement, a descriptive text is included with the report. If there are no descriptive texts following this introduction, all essential element levels are within acceptable range. All reference ranges are age and sex specific.

Boron High

Boron (B) is introduced to the body mainly through food (noncitrus fruits, leafy vegetables, nuts, legumes, wine, cider, beer) and drinking water but is also found in food preservatives (sodium borate), and insecticides (boric acid). Evidence for biological essentiality in animals (including humans) has been presented. It has been proposed that boron contributes to living systems by acting indirectly as a proton donor and that it exerts a particular influence on cell membrane and structure and function. In humans boron is responsible for the hydroxylation of various substances in the body. It may enhance the production of various hormones such as testosterone, estrogen, DHEA, and 1,25 dihydroxycholecalciferol. Boron is very readily absorbed and excreted in the urine yet its concentration remains quite low in the serum. Based on urinary recovery findings, more than 90% of ingested B is usually absorbed. Boron is distributed throughout the tissues and organs of animals and humans at concentrations mostly between 4.6 and 55.5 nmol (0.05 and 0.6 µg)/g fresh weight. Among the organs that contain the highest amounts of B are bone, spleen, and thyroid. It appears to be most concentrated in the thyroid gland.

Boron has a low order of toxicity even with intakes as high as 40mg/day in some parts of the world. However, high body burden of the element may be harmful, especially to young animals (including human neonates). Reports have shown that when doses equivalent to more than 46 mmol (0.5 g) B daily were consumed, disturbances in appetite, digestion, and health occurred. Acute toxicity signs include nausea, vomiting, diarrhea, dermatitis, and lethargy. High B ingestion also induces riboflavinuria.

Chromium High

The chromium level in this urine sample is high. Chromium (Cr) is essential for proper metabolism of glucose in humans. It potentiates the action of insulin via glucose tolerance factor (GTF) which is Cr+3 bound in a dinicotinic acid-glutathione complex. Other functions of Cr include aiding in lipid metabolism and assisting with HDL/LDL cholesterol balance.

Sources of exposure to hexavalent Cr (Cr+6) include: manufacture and use of ferrochromium and stainless steel, chromium plating (plumbing, electrical appliances, automotive parts), welding, commercial spray painting, wood finishing and leather tanning industries, and handling of cement. Extensive mining of Cr and disposal of spent ore presents a serious environmental problem in certain regions.

The molecular process of reducing Cr+6 to Cr+3 determines the degree of Cr toxicity due to the fact that Cr+6 can react with, for example, reduced glutathione, ascorbic acid, NADH, NADPH, lipids, proteins, and nucleic acids.

Phytates decrease oral assimilation of Cr+3 whereas nicotinic acid and vitamin C increase absorption of Cr+3. Zinc, vanadium and iron compete with Cr for absorption.

Significance of High Chromium: When present in excessive amounts, Cr+6 may be mutagenic and carcinogenic. Elevated Cr levels have been found in patients with cerebral thrombosis and cerebral hemorrhage. Self-supplementation has been reported to be associated with insomnia and increased unpleasant dream activity in some individuals. Exposure to Cr via excessive skin contact with reactive chemical forms can result in allergic dermatitis (sometimes with permanent skin sensitization to chromium) skin ulcers, bronchitis, and lung and nasal carcinomas. Systemic effects of absorbed Cr+6 may feature bronchial asthma (from inhaling Cr dusts) and kidney and/or liver dysfunction.

Other Useful Analyses: Depending upon the route of absorption of chromium, dermatological chromium problems may or may not be reflected by whole blood levels. Measurement of hyaluronidase activity in serum may be helpful as this has been seen to increase in Cr overexposure. Hair element analysis can be used to corroborate suspected recent Cr exposure. Provocative urine testing with EDTA can be used to assess Cr stores. EDTA, but not DMPS or DMSA, is an effective chelator of Cr.

Copper Low

Low urinary copper may or may not correspond to subnormal copper levels in body tissues, and other laboratory tests are more indicative of copper status. Such tests include measurement of: whole blood or blood cell copper, hair copper, erythrocyte superoxide dismutase activity, and serum ceruloplasmin.Because the major route of copper excretion is via bile and feces, urinary levels may fluctuate without reflecting or influencing body stores.

Lower than normal excretion of copper (and other elements) can occur in renal insufficiency; in which case blood levels may be normal or elevated. Inadequate levels of molybdenum or zinc allow increased retention of copper, and transient hypocuprinuria may occur during periods when copper stores are accumulating.

Low urinary copper may also correspond to copper deficiency of nutritional or gastrointestinal origins.The richest dietary sources of copper are: nuts, shellfish, liver, raisins and legumes. Dairy products generally are low in copper content. Gastric hypochlorhydria, sprue, and pancreatic dysfunction may inhibit copper uptake.

Magnesium High

This individual's magnesium level exceeds one standard deviation above the mean of the reference population which means that this individual's urine magnesium level corresponds to the highest 17% (approximately) of that population.

Elevated urine magnesium is an expected finding after administration of EDTA, with levels of 150 to 300 mg/24 hr commonly seen (adults). Elevated urine magnesium is not expected with administration of sulfhydryl agents (DMPS, DMSA, D-penicillamine).

Homeostatic regulation of blood magnesium levels is normally maintained within close limits, and homeostasis closely controls intestinal uptake and renal conservation. There are, however, many possible metabolic, hormonal, drug and (toxic) chemical influences which can increase renal excretion of magnesium, perhaps causing "magnesium wasting". These are listed below.

- Hypermagnesemia, excessive infusion of magnesium
- Hypercalcinuria/hypercalcinemia, excessive supplementation or infusion of calcium
- Hyperphosphaturia/hypophosphatemia
- Hypokalemia with urinary potassium wasting
- Hyperaldosteronism
- Hyperparathyroidism
- Alcoholism
- Hypertaurinuria/hypotaurinemia
- Diuresis: diabetes, use of thiazides, other diuretics
- Acidosis: fasting, diabetic ketoacidosis
- Renal tubular dysfunction/damage, postrenal obstruction, nephritis, Bartter's syndrome
- Nephrotoxic drugs/chemicals: amphotericin, cisplatin, aminoglycides, cyclosporin, theophylline, pentamidine.

Many pesticides, herbicides and fungicides are nephrotoxic, and may cause renal wasting; others may cause renal insufficiency, depending upon dose and time elapsed after exposure (Kuloyanova and El Batawi, Human Toxicology of Pesticides, CRC Press 1991; Sittig, Pesticide Manufacturing and Toxic Materials Control Encyclopedia, Noyes Data Corp., 1980).

Magnesium status can be difficult to assess; whole blood and blood cell levels are more indicative than serum/plasma levels. The magnesium challenge method may be most indicative: baseline 24-hour urine Mg measurement, followed by 0.2 mEq/Kg of intravenous Mg, followed by 24-hour Mg measurement. A deficiency is judged to be present if less than 80% of the Mg challenge is excreted. Ref. Jones, et al. "Magnesium Requirements in Adults", Med Journal Clin Nutr, 20 (1967) p.632-35.

Potassium High

The level of potassium (K) is higher than expected in this sample. Symptoms of elevated K may include mental confusion, weakness, numbness, tingling in the extremities, brady-cardia or irregular heart rhythm and ventricular fibrillation.

K is an electrolyte and a potentiator of enzymatic reactions in the body. Elevated K in hair may reflect overall retention of K by the body or maldistribution of this element. In adrenocortical insufficiency, K is increased in blood, while it is decreased in urine; cellular K may or may not be increased.

Appropriate tests to confirm excess K in body tissues may include measurements of packed red blood cell K; serum or whole blood K and sodium/K ratio. An assessment of adrenocortical function may be indicated for symptomatic patients with a confirmed elevation in serum K.

Selenium High

Urine accounts for about one-half of the total body excretion of dietary selenium when normal amounts are ingested. Seafood, organ meats, cereal grains, and seleniferous vegetables (garlic, onions) are good dietary sources. Selenium is also excreted in sweat, and lesser amounts are present in fecal matter. Because diets are highly variable in selenium content, urine is not a reliable indicator of selenium adequacy or function. However, selenium excess or overload can feature high urinary levels. Without occupational or environmental exposure, or excessive dietary intake, urinary selenium is expected to be below 100 micrograms per liter.

Selenium can be toxic with long-term intake as low as 750 mcg/day. Essential daily selenium requirements range from 10 micrograms (infants) to 50-70 micrograms (adults). Some manifestations of chronic selenium exposure are: fatigue, jaundice, hyperpigmentation of skin, unstable blood pressure, reddish discoloration and structural degeneration of nails and teeth, and dizziness. A garlic-like breath odor usually occurs and there may be a metallic taste in the mouth. Acute selenium contamination generally occurs from inhalation of selenium fumes which inflame mucous membranes and cause coughing and irritation of eyes and nasal passages.

Packed red blood cell elements analysis is a more definite test for selenium status. Hair analysis may provide confirmation of selenium excess if exogenous sources of contamination(antidandruff shampoos) are eliminated.

Strontium High

The primary use of Strontium (Sr) has been in the production of glass for color television cathode ray tubes (to block x-ray emissions) and in the production of metal alloys (e.g.aluminum, magnesium). The stable form of Sr is not known to pose any health threat. The prescription drug Strontium Ranelate is used in many countries (but not Canada or the USA) to increase bone density and reduce the occurrence of fractures. The isotope 90Sr (found in nuclear fallout) can lead to bone disorders, including bone cancer. The isotope 89Sr is a beta emitter used for palliation of pain in patients with metastatic bone cancer - after intravenous administration, up to 80% of the isotope is eliminated in urine (1).

Urine Sr levels provides useful information in the biological monitoring of the presence of this element in individuals therapeutically or environmentally exposed to Sr.