105 - 32 Royal Vista Dr NW
Calgary, AB T3R 0H9
www.rmalab.com
Phone: 403-241-4500
Fax: 403-241-4516

Advancing the Science of Wellness
Rocky Mountain Analytical

Date of Collection: 12-Apr-2016
Sample Received: 15-Apr-2016
Reported Date: 12-May-2016
Sample Type: Urine

Iodine Plus — Accession # 500000

Healthcare Professional:
Jane Doe ND

Patient:

Gender : F
Date of Birth : 13-Aug-1977
Age: 38

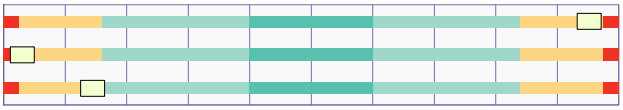
Relevant Medications	Last Used

Biometrics

Height (in) : 64
Weight (lb) : 123
Waist (in) : 27
Hip (in) : 35

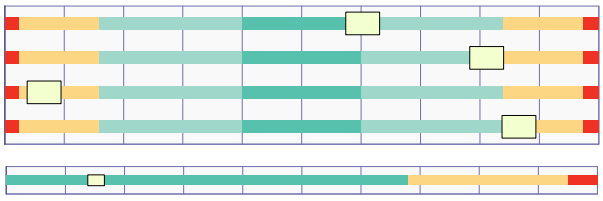
Raw Concentration (µg/L)

Analyte	Result	Range	Percentile	Range Applied
Iodine AM	350	48 - 210	95%	Iodine ug/L (AM)
Br / I AM	< 5.0	7.1 - 29	< 3.0%	Br/ Iodine (AM)
Bromine AM	800	840 - 2,400	14%	Br ug/L (AM)



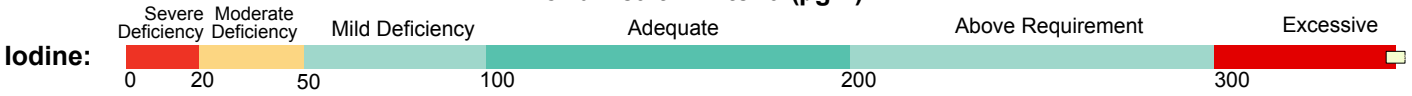
Creatinine Normalized

Analyte	Result	Range	Percentile	Range Applied
Selenium AM	0.080	0.051 - 0.10	60%	Se/Cr F >= 12 yr
Iodine AM	210	42 - 230	81%	I/Cr AM (F)
Bromine AM	470	750 - 2,500	6.6%	Br/Cr AM (F)
Creatinine AM for Iodine+	1.7	0.53 - 1.6	87%	Creat. AM (F)
Cadmium AM	0.13	< 0.43	15%	Cd/Cr F >= 12 yr



The number listed for the Cadmium range represents the 68th percentile, whereas the numbers listed for the other analytes represent the 16th and 84th percentiles.

World Health Criteria (µg/L)



CADMIUM REFERENCE RANGE CHANGE
Effective January 5, 2016 new reference ranges for Cadmium have been implemented, to reflect a change in the correction scheme for interelement interference. The new ranges are lower, but since the measured levels are also lower, this will not affect the clinical utility of the test in any way.

WORLD HEALTH ORGANIZATION (WHO) RANGES FOR FIRST MORNING URINE IODINE
The ranges cited by the WHO are listed below. Urine iodine reflects recent iodine intake. A low result does not automatically mean that the individual is deficient in iodine, nor does a low result automatically mean that the individual needs to be supplemented with iodine. Urine iodine measurements do not automatically correlate with clinical evidence of thyroid problems.

Bear in mind that if a patient is consistently found to have very low iodine excretion (reflecting low intake) over an extended period of time, then it is not unreasonable to expect that the patient will eventually manifest signs and symptoms of iodine deficiency.

Men and Non-Pregnant Women
<20 ug/L: Severe deficiency
20-49 ug/L: Moderate deficiency
50-99 ug/L: Mild deficiency
100-199 ug/L: Adequate
200-299 ug/L: Above requirement
>= 300 ug/L: Excessive

Pregnant Women
<150 ug/L: Insufficient
150-249 ug/L: Sufficient

IODINE AND PREGNANCY
Hynes et al looked at 228 children born to mothers from an iodine-poor environment whose average iodine level during pregnancy was less than 150 ug/L. Although their children grew up with adequate exposure to iodine, at age 9 they were found to have statistically significant decreases in spelling, grammar and English literacy, compared to the offspring of mothers who had iodine levels >150 ug/L during pregnancy.

Hynes K et al. Mild iodine deficiency during pregnancy is associated with reduced educational outcomes in the offspring: 9-year follow-up of the Gestational Iodine Cohort. J Clin Endocrinol Metab 2013. 98(5):1954-1962.

IODINE CONCENTRATION GREATER THAN 299 ug/L
This patient's raw iodine concentration is 350 ug/L. According to the WHO standards, this is considered "Excessive". Technically those standards apply to first morning urine, but the results should still be roughly the same for 24 hour urine. As mentioned, this is a snapshot of recent iodine intake, but if iodine in this range is a consistent finding, the practitioner needs to review the patient's diet and supplementation.

Signs and symptoms of chronic iodine excess can include altered taste, a metallic taste and nausea. Excess iodine can also trigger hypothyroidism and autoimmune thyroiditis.

If this is a 24 hour urine specimen, the high iodine result may sometimes reflect excessively concentrated urine if the collection volume is well under 1 litre and the creatinine is above 2 g/L.

Note that administration of selenium increases iodine excretion even in the absence of iodine supplementation, presumably by facilitating conversion of T4 to T3 (selenium is a cofactor for the deiodinase enzyme responsible for the conversion) and "freeing up" an iodine atom.

BROMINE: BACKGROUND INFORMATION
Bromine is a nonessential chemical element, but is found in relatively large amounts in the food supply where it is a component of many pesticides and fumigants; bromine is also present in many pharmaceuticals and organic chemicals such as flame retardants, and is also used as a disinfectant in hot tubs. Potassium bromate is an additive in commercial baking flour. As a consequence, most individuals have a considerable body burden of bromine.

Bromine is quickly distributed throughout body tissues where it displaces chlorine. In the thyroid gland, it replaces iodine rather than chlorine. (Vobecky 1996) Bromine interferes with the uptake and utilization of iodine in some tissues, since it is similar in size and chemical reactivity, to iodine.

Data on elimination of bromine from the body are scanty, but urine is the principal route of excretion for iodine; urine contains relatively large amounts of bromine and due to its similarity to iodine, urine is also expected to be the principal excretion route for bromine.

Bromine accumulation may present with neurologic symptoms such as irritability, restlessness, weakness, and stupor. Other symptoms and signs include nausea, anorexia and skin rashes. Since it may displace iodine from binding sites, bromine excess may present with signs and symptoms of hypothyroidism. Pathological thyroid tissue including cold nodules has been shown to contain markedly high levels of bromine. (Malenchenko)There is also evidence that exposure to methyl bromide is associated with an increased risk of prostate cancer. (Budnik)

Budnik LT, Kloth S, Velasco-Garrido M, Baur X. Environ Health 2012;11:5. Prostate cancer and toxicity from critical use exemptions of methyl bromide:
environmental protection helps protect against human health risks.

Malenchenko AF, Demidchik EP, Tadeush VN. Med Radiol (Mosk)1984;29:19-22.[Content and distribution of iodine, chlorine and bromine in normal and
pathologically changed thyroid gland tissue].

Vobecký M, Babický A, Lener J, Svandová E. Biol Trace Elem Res 1996;54:207-212. Interaction of bromine with iodine in the rat thyroid gland at enhanced bromide intake.

PERCENTILE FOR BROMINE / IODINE CANNOT BE EXPLICITLY CALCULATED
The ratio Br/I for this patient is well below the lowest result seen in the dataset which was used to calculate the normal ranges. The statistical model used for the normal ranges was therefore not able to give an exact percentile and returned an estimate instead. In any event, the ratio is still very low.

RATIO: BROMINE/IODINE (Br/I)
There is some support for the notion that iodine "displaces" bromine. Data analysis at RMA indicates that bromine and iodine are positively correlated: higher bromine excretion is associated with higher iodine excretion. Abraham has also published research indicating that iodine supplementation increases bromine excretion. (Abraham GE. “Iodine supplementation markedly increases urinary excretion of fluoride and bromide.” Townsend Letter, 2003; 238:108-109).

The median "background" ratio, in persons who are not supplementing with iodine, is approximately 10 to 12. Here, the ratio is 2.3. Higher ratios might be expected in individuals supplementing with iodine but may also be seen when iodine excretion is markedly low.

Lower ratios, especially in the face of iodine supplementation, might indicate a lower body burden of bromine, but this needs to be confirmed by additional research.

SELENIUM MORE OR LESS WITHIN MIDDLE TERTILE
Selenium is important to health as it is an important cofactor for conversion of the thyroid hormone T4, to the most active form, T3.

Approximately half of ingested selenium appears in urine, so urine reflects selenium intake to a certain extent. For example, selenium measured from a 24 hour urine collection has been shown to reflect dietary intake as well as supplementation. (In the Japanese INTERMAP study, 24 hour urinary excretion of selenium correlated to selenium intake (Yoneyama et al. Eur J Clin Nutr. 2008 Oct;62(10):1187-93.) 24 hour urinary excretion of selenium is also reflective of supplemental selenium (Burk R et al. Cancer Epidemiol Biomarkers Prev 2006;15:804-810).

We have found that there is a good correlation between the creatinine-normalized selenium concentration in a first morning urine specimen, and that found in a 24-hour collection.

The selenium result here is between the 33rd and 75th percentiles, which is approximately the middle 1/3 of

the reference population. The patient indicates that they are not taking a specific selenium supplement, but most multivitamins contain some selenium. For optimum activity of thyroid hormones in target tissues, it is probably desirable to maintain selenium in the middle tertile, as is the case here.

Selenium-containing foods include nuts and whole grains, liver, fish, and Brewer's Yeast.

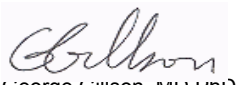
CADMIUM EXCRETION
Cadmium was also measured on this specimen. Cadmium is relevant here as it is a potential inhibitor of the enzyme which converts the thyroid hormone T4 to the most active form T3. Elevated levels of cadmium might therefore impair the ability to realize adequate levels of T3 in target tissues.

Urinary cadmium is fairly reflective of dietary intake, but quite reliably reflects renal accumulation, which in turn reflects body burden.

Some cadmium is present in food. Organ meats (kidney, liver) and leafy vegetables such as lettuce and spinach tend to be higher in cadmium. Rice grown in contaminated paddies may be high in cadmium. Seafood can be a significant source of cadmium exposure. (Essential and toxic element concentrations in blood and urine and their associations with diet: results from a Norwegian population study including high-consumers of seafood and game. Birgisdottir BE, Knutsen HK, Haugen M et al. Sci Total Environ 2013;463-464:836-844)

Note that smoking results in significant cadmium intake (tobacco leaves concentrate cadmium naturally from the soil). Some yellow, red and orange pigments (paints, ceramic glazes) may contain cadmium. The cadmium content in children's jewelry imported from China may sometimes exceed 91% of the item's weight (The Associated Press, January 11, 2010). Other industries where one might be exposed to cadmium include smelting, manufacture of cadmium alloys, electroplating, manufacture of Nicad batteries and photoelectric cells. Some types of solder contain cadmium, and some welding is done with cadmium-containing electrodes. Denturists can be exposed to cadmium.

Excess cadmium exerts negative effects on many systems including renal, cardiovascular, pulmonary and neurologic.



George Gillson, MD PhD
Medical Director