LAB #: B000000-0000-0
PATIENT: Sample Patient
ID: PATIENT-S-00008
SEX: Female
AGE: 49

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

Toxic & Essential Elements; Packed Red Blood Cells

ESSENTIAL AND OTHER ELEMENTS		RESULT / UNIT	REFERENCE INTERVAL	PERCENTILE 2.5th 16th 50th 84th 97.5th
Calcium	(Ca)	**9** µg/g	8- 26	
Magnesium	(Mg)	**47** µg/g	39- 59	
Potassium	(K)	**83** mEq/L	70- 90	
Phosphorus	(P)	**638** µg/g	510- 700	
Copper	(Cu)	**0.59** µg/g	0.52- 0.80	
Zinc	(Zn)	**10.0** µg/g	8.6- 14.5	
Iron	(Fe)	**782** µg/g	780- 1000	
Manganese	(Mn)	**0.022** µg/g	0.009- 0.033	
Chromium	(Cr)	**0.0005** µg/g	0.0003-0.0020	
Selenium	(Se)	**0.21** µg/g	0.19- 0.50	
Boron	(B)	**0.026** µg/g	0.01- 0.110	
Vanadium	(V)	**0.0002** µg/g	0.0001-0.0005	
Molybdenum	(Mo)	**0.0007** µg/g	0.0006-0.0020	

TOXIC METALS		RESULT / UNIT	REFERENCE INTERVAL	PERCENTILE 95th 99th
Arsenic	(As)	**0.004** µg/g	< 0.010	
Cadmium	(Cd)	**< 0.0008** µg/g	< 0.002	
Lead	(Pb)	**0.022** µg/g	< 0.050	
Mercury	(Hg)	**0.001** µg/g	< 0.010	
Thallium	(Tl)	**< 0.0001** µg/g	< 0.0005	

SPECIMEN DATA

Comments:

Date Collected: **11/15/2011**
Date Received: **11/28/2011**
Date Completed: **11/29/2011**

Methodology: **ICP-MS**

v8.10

PACKED BLOOD CELL ELEMENTS REPORT

INTRODUCTION

This analysis of elements in packed blood cells was performed by ICP-Mass Spectroscopy following acid digestion of the specimen in a closed microwave system. For a given element, these procedures measure the sum of the amounts of surface-adhering and intracellular content, regardless of chemical form. For units of measurement, mg/l is approximately equivalent to ppm, and mcg/l is approximately equivalent to ppb.

The packed cells are not washed, and therefore, a very small amount of residual plasma remains as part of the specimen. Washing would eliminate some important plasma membrane-bound elements. Because the cells are not washed, the DDI reference range may vary from published ranges for intracellular content of washed erythrocytes. Blood cell specimens that are not adequately centrifuged, per the kit instructions, may yield distorted or invalid results because of excess plasma content.

Packed blood cell analysis is intended to be a diagnostic method of assessing insufficiency or excess of elements that have important functions inside blood cells or on blood cell membranes. Additional testing of whole blood or serum/plasma or other body tissues may be necessary for differential diagnosis of imbalances. Additional testing also may be necessary to assess specific dysfunctions of assimilation, transport, retention, or excretion of elements. Packed blood cell element analysis is additionally intended to determine elevated or excessive levels of five potentially toxic elements that can accumulate in erythrocytes: antimony, arsenic, cadmium, lead, and mercury.

If an element is sufficiently abnormal per the blood cell measurement, a descriptive text is included with the report. For elements with essential or beneficial functions, a text will print if the measured result is below -1.5 standard deviations from the mean of the reference population, or if the result is above +1.5 standard deviations from the mean of the reference population. For potentially toxic elements, a text prints whenever the measured result exceeds the expected range. If no descriptive element texts follow this introductory discussion, then all essential cell elements were measured to be within +1.5 SD, and all measured potentially toxic elements were within expected ranges.

Doctor’s Data states the reference range as +1 SD from the mean of the reference population. This is considered to be the nutritionally and physiologically optimal range for elements with essential or beneficial functions. Physiological imbalance corresponds to levels beyond +1 SD but pathological consequences are not expected until the blood level is beyond +2 SD. Element levels beyond +2 SD may only be temporary nutritional problems or they may reflect a failure of homeostasis to control blood quantities. Pathological consequences depend upon cell and tissue functions which are disrupted by such levels.

IRON LOW

Nominally, about 97% of erythrocyte iron (Fe) is ferrous iron bound as heme in hemoglobin; only about 3% is nonheme iron. Thus, the packed blood cell Fe measurement is essentially a measurement of the heme iron content of erythrocytes. The fraction of whole blood volume that

constitutes erythrocytes, or the packed cell volume (the ”hematocrit”), does not directly influence the packed cell iron result.

Diagnostic testing to assess whether there is anemia requires measurement of red blood cell structure and quantity relative to the whole blood volume. The iron content of erythrocytes would then indicate if the condition is hypochromic (low heme-iron), normochromic (normal heme-iron) or hyperchromic (high heme-iron).

A low packed cell Fe result does not necessarily mean anemia, and diagnostic hematology procedures are suggested when this result is found. Possible reasons for low iron or low hemoglobin in erythrocytes are those of iron deficiency, but not necessarily those of low RBCs or low hematocrit. Sickle cell anemia, thalassemia and disorders of hemoglobin metabolism can feature low packed cell iron.

The suggested tests to assess iron assimilation are those for: serum iron level, serum ferritin, total iron binding capacity, percent saturation of transferr in, investigations of blood loss, dietary iron intake, dietary interferences (phosphates, phytates, oxalates, excess coffee or tea), GI function (especially sufficiency of gastric function), and whole blood or serum copper level.

BIBLIOGRAPHY ON BLOOD CELL IRON, LOW

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4. Harris E.D. ”Iron-Copper Interactions: Some New Revelations” Nutr. Reviews 52(9), 1994, pp 311-19.

5. Bunn H.F. ”Disorders of Hemoglobin”, Chapt 306 in Harrison’s Principles of Internal Medicine, 13th ed, McGraw-Hill, New York, NY1994, pp 1734-43.

SELENIUM LOW

Selenium (Se) has two documented functions as an enzyme activator in humans: (1) activation of the enzyme T4 to T3 prohormone deiodinase for balance in thyroid hormone level, and (2) activation of glutathione peroxidase for reduction of peroxides by oxidation of glutathione. Erythrocytes are a tissue of choice for assessing glutathione peroxidase function and selenium status. In its antioxidant function, selenium works with vitamin E. Vitamin E functions to prevent oxidation of cell membranes and fatty acids, while glutathione, via the peroxidase enzyme, works to undo oxidation after it has happened.

Symptoms and conditions that can result from Se deficiency include: increased susceptibility to viral infections, increased inflammation during infection or following exposure to xenobiotics or

oxidant chemicals, hardening or sclerosing of tissue, muscle pain and tenderness, and possibly hypothyroid function with subnormal T3.

Selenium deficiency usually is the result of a poor quality diet or one which has emphasized highly refined foods. However, there are geographical regions in the world where the soil contains little Se, and even unprocessed food grown in such soils can be deficient in Se. Selenium often is lost through urinary wasting in cystinuria; hyperaminoaciduria conditions and renal transport disorders may feature Se wasting.

Laboratory tests for further assessment of Se status are: determination of erythrocyte glutathione peroxidase functional activity, measurement of serum T3 and T4, and measurement of hair Se level (barring exogenous Se contamination primarily from shampoos). 24-hour urine amino acid analysis may be informative if Se wasting is suspected.

BIBLIOGRAPHY FOR BLOOD CELL SELENIUM, LOW

1. Paglia D.E. et al, ”Studies on the Quantitative and Qualitative Characterization of Erythrocyte Glutathione Peroxidase”. J. Lab andClin Med 70(1), 1967 pp 158-69.

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3. Dhur A. et al, ”Relationship between Selenium, Immunity and Resistance against Infection” Comp. Biochem. Physiol. 966(2), 1990pp 271-80.
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