Patient Name: DEMO DEMO
Date of Birth: 01-01-1111 Accession ID: 2306040032
Service Date: 2023-08-16 13:33 (PDT)

Micronutrients - Summary

Micronutrient

Cellular Serum

Test Name	Reference	Current	Previous	Abnormal
Bone, Joint and Muscle Health	≥80	78/100		Low: Vitamin K2 (Cellular)
Cardiovascular Health	≥80	81/100		High: Isoleucine (Serum), Leucine (Serum) Moderate: Omega-3 Index (Cellular) Low: Vitamin K2 (Cellular)
Gastrointestinal Barrier	≥80	74/100		High: Cysteine (Serum)
Liver Detoxification	≥80	84/100		High: Cysteine (Serum), Leucine (Serum)
Mitochondrial function, Skin and Anti Aging	≥80	83/100		High: Cysteine (Serum)
Neurological, Cognitive function and Mood	≥80	79/100		High: Cysteine (Serum) Low: Vitamin K1 (Cellular)

Micronutrient

Fatty Acids: Omega-3 & 6	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference
AA/EPA				33.8		2.5-10.9

PHYSIOLOGICAL FUNCTION

The AA/EPA ratio, representing the balance between Arachidonic Acid (AA) and Eicosapentaenoic Acid (EPA), is a crucial marker for assessing the body's inflammatory status. AA is pro-inflammatory, while EPA is anti-inflammatory. An optimal ratio is essential for maintaining cellular health and mitigating chronic inflammation.

HOW IT GETS DEPLETED

The AA/EPA ratio can become imbalanced due to dietary habits, particularly from consuming high amounts of omega-6 fatty acids (leading to higher AA) and low intake of omega-3 fatty acids (resulting in lower EPA). Lifestyle factors and genetic predispositions also play a role.

CLINICAL MANIFESTATIONS OF DEPLETION

An elevated AA/EPA ratio is associated with increased risk of chronic inflammatory diseases, cardiovascular problems, and mental health issues. A lower ratio is generally considered beneficial and indicative of reduced inflammatory risk.

FOOD SOURCES

AA is found in animal-based foods, while EPA is primarily in fatty fish. The ratio can be managed by adjusting dietary intake of these sources, increasing omega-3-rich foods, and reducing omega-6-rich foods.

SUPPLEMENT OPTIONS

The AA/EPA ratio, representing the balance between Arachidonic Acid (AA) and Eicosapentaenoic Acid (EPA), is a crucial marker for assessing the body's inflammatory status. AA is pro-inflammatory, while EPA is anti-inflammatory. An optimal ratio is essential for maintaining cellular health and mitigating chronic inflammation.

Fatty Acids: Omega-3 & 6	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference
Omega-3 Index				5		8.0-12.65 (%)

PHYSIOLOGICAL FUNCTION

Omega-3 Index is the sum of EPA % and DHA % as measured in whole blood, and derived by validated calculations to yield the equivalent sum of EPA % and DHA % in red blood cell membranes. Please note this value is a percentage, with the denominator being the sum of all Fatty Acids measured in the blood and thus the index can vary based on fatty acid composition of the diet. The index can be used as an indicator of risk for sudden cardiac death and nonfatal cardiovascular events and as a therapeutic target. It can also be used to assess adherence to omega-3 therapy and/or success or failure of such therapy. Optimal omega-3 index positively impacts heart rate, blood pressure, triglyceride levels, myocardial efficiency, inflammatory responses, and endothelial function while also improving cognitive function.

HOW IT GETS DEPLETED

The Omega-3 Index is a validated biomarker of tissue membrane omega-3 (n-3) polyunsaturated fatty acid (PUFA) status. The ratio is expressed as a percentage where the denominator is the sum of all fatty acids measured in the blood. Thus, a decrease in the ratio can be caused by a low intake of omega-3 fatty acids and incorporation of those fatty acids into cell membranes; or due to a proportionally high intake of other dietary fatty acids (saturated fatty acids, mono-unsaturated fatty acids and omega-6's polyunsaturated fatty acids).

CLINICAL MANIFESTATIONS OF DEPLETION

Low levels of omega-3 index are associated with increased risk for cardiac death.

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Micronutrients - Summary

Micronutrient

Fatty Acids: Omega-3 & 6	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference
Omega-3 Index				5		8.0-12.65 (%)

FOOD SOURCES

If omega-3 index is <8.0% it is advised to increase dietary sources of omega-3's (EPA and DHA) from both plant and animal sources. Because the omega-3 index is a relative ratio of omega-3 compared to all other fatty acids in the blood, it is also important to evaluate intake of all other dietary fatty acids (saturated fatty acids, mono-unsaturated fatty acids and omega-6's polyunsaturated fatty acids).

SUPPLEMENT OPTIONS

Omega-3 Index is the sum of EPA % and DHA % as measured in whole blood, and derived by validated calculations to yield the equivalent sum of EPA % and DHA % in red blood cell membranes. Please note this value is a percentage, with the denominator being the sum of all Fatty Acids measured in the blood and thus the index can vary based on fatty acid composition of the diet. The index can be used as an indicator of risk for sudden cardiac death and nonfatal cardiovascular events and as a therapeutic target. It can also be used to assess adherence to omega-3 therapy and/or success or failure of such therapy. Optimal omega-3 index positively impacts heart rate, blood pressure, triglyceride levels, myocardial efficiency, inflammatory responses, and endothelial function while also improving cognitive function.

Antioxidants	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference
Cysteine	40.8		3.4-37.0 (nmol/mL)	412.7		60.0-565.0 (pg/MM WBC)

PHYSIOLOGICAL FUNCTION

Cysteine has antioxidant properties itself, but is also a precursor molecule to glutathione production, the master antioxidant. Cysteine is also an important source of sulfide for iron-sulfide metabolism. Cysteine will bind metals easily to its thiol group, such as iron, nickel, copper, zinc, and heavy metals such as mercury and lead, which may confer some chelation benefits. Cysteine counteracts acetaldehyde effects from consumption of alcohol and can reduce hangovers.

HOW IT GETS DEPLETED

Cysteine can be synthesized endogenously as long as sufficient methionine is available in the diet. Depletion is extremely rare.

CLINICAL MANIFESTATIONS OF DEPLETION

Depletion or deficiency of cysteine is not common, as cysteine can be made endogenously, but can conditionally be required in greater amounts due to its strong antioxidant and detoxification properties.

FOOD SOURCES

Dietary sources of cysteine include: meat, poultry, eggs, dairy, red peppers, garlic, onions, broccoli, Brussels sprouts, oats, granola, wheat germ, and lentils.

SUPPLEMENT OPTIONS

Cysteine has antioxidant properties itself, but is also a precursor molecule to glutathione production, the master antioxidant. Cysteine is also an important source of sulfide for iron-sulfide metabolism. Cysteine will bind metals easily to its thiol group, such as iron, nickel, copper, zinc, and heavy metals such as mercury and lead, which may confer some chelation benefits. Cysteine counteracts acetaldehyde effects from consumption of alcohol and can reduce hangovers.

Amino Acids	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference

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Micronutrients - Summary

Micronutrient

Amino Acids	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference
Isoleucine	179.4		25.5-158.9 (nmol/mL)			

PHYSIOLOGICAL FUNCTION

Isoleucine is an essential branched-chain aliphatic amino acid found in many proteins. It is an isomer of leucine. It is important in hemoglobin synthesis and regulation of blood sugar and energy levels. Isoleucine is one of nine essential amino acids in humans (present in dietary proteins). It has diverse physiological functions, such as assisting wound healing, detoxification of nitrogenous wastes, stimulating immune function, and promoting secretion of several hormones.

HOW IT GETS DEPLETED

Isoleucine is necessary for hemoglobin formation and regulating blood sugar and energy levels. Isoleucine is concentrated in muscle tissues in humans. Deficiency is primarily due to low total protein intake, but may be found in individuals with prolonged or severe reduced digestive capacity, particularly those who have trouble digesting protein or with more severe hypochlorhydria.

CLINICAL MANIFESTATIONS OF DEPLETION

Isoleucine deficiency is marked by muscle tremors. All 3 BCAAs are decreased in patients with liver disease, such as hepatitis, hepatic coma, cirrhosis, or extrahepatic biliary atresia. L-isoleucine is found to be associated with maple syrup urine disease, which is an inborn error of metabolism.

FOOD SOURCES

Isoleucine is found especially in meats, fish, cheese, eggs, and most seeds and nuts.

SUPPLEMENT OPTIONS

Isoleucine is an essential branched-chain aliphatic amino acid found in many proteins. It is an isomer of leucine. It is important in hemoglobin synthesis and regulation of blood sugar and energy levels. Isoleucine is one of nine essential amino acids in humans (present in dietary proteins). It has diverse physiological functions, such as assisting wound healing, detoxification of nitrogenous wastes, stimulating immune function, and promoting secretion of several hormones.

Amino Acids	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference
Leucine	>250		101.2-249.3 (nmol/mL)			

PHYSIOLOGICAL FUNCTION

Leucine is one of nine essential amino acids in humans (provided by food). Leucine is important for protein synthesis and many metabolic functions. Leucine contributes to regulation of blood-sugar levels, growth and repair of muscle and bone tissue, growth hormone production, and wound healing. Leucine also prevents breakdown of muscle proteins after trauma or severe stress and may be beneficial for individuals with phenylketonuria.

HOW IT GETS DEPLETED

Leucine is available in many foods and deficiency is rare.

CLINICAL MANIFESTATIONS OF DEPLETION

Leucine supplementation alone exacerbates pellagra and can cause psychosis in pellagra patients by increasing excretion of niacin in the urine. Leucine may lower brain serotonin and dopamine.

Micronutrients - Summary

Micronutrient

Amino Acids	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference
Leucine	>250		101.2-249.3 (nmol/mL)			

FOOD SOURCES

Leucine is more highly concentrated in foods than other amino acids. A cup of milk contains 800 mg of leucine and only 500 mg of isoleucine and valine. A cup of wheat germ has about 1.6 g of leucine and 1 g of isoleucine and valine. The ratio evens out in eggs and cheese. One egg and an ounce of most cheeses each contain about 400 mg of leucine and 400 mg of valine and isoleucine. The ratio of leucine to other BCAA is greatest in pork, where leucine is 7 to 8 g and the other BCAA together are only 3-4 grams.

SUPPLEMENT OPTIONS

Leucine is one of nine essential amino acids in humans (provided by food). Leucine is important for protein synthesis and many metabolic functions. Leucine contributes to regulation of blood-sugar levels, growth and repair of muscle and bone tissue, growth hormone production, and wound healing. Leucine also prevents breakdown of muscle proteins after trauma or severe stress and may be beneficial for individuals with phenylketonuria.

Vitamins	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference
Vitamin K1	0.82		0.1-8.1 (ng/mL)	0.08		0.1-0.71 (pg/MM WBC)

PHYSIOLOGICAL FUNCTION

Vitamin K is a group of fat-soluble vitamins. This group of vitamins includes two natural vitamins: vitamin K1 and vitamin K2. These Vitamins are structurally similar and their name comes from the German word 'klotting'. Vitamin K1, also known as phylloquinone, assists with blood clotting, supports the formation of bone and bone matrix, and aids in glucose to glycogen conversion for storage in the liver.

HOW IT GETS DEPLETED

Dietary deficiency of vitamin K is extremely rare unless there has been significant damage to the intestinal lining, such as in inflammatory bowel disorders (Crohn’s, ulcerative colitis, etc), liver disease, cystic fibrosis, and fat malabsorption disorders. Taking broad-spectrum antibiotics can reduce vitamin K production in the gut. Individuals with chronic kidney disease are at risk for vitamin K deficiency. Individuals with ApoE4 genotype may be at greater risk for low vitamin K. Since Vitamin K is a fat-soluble vitamin, following a chronically low-fat diet can inhibit absorption.

CLINICAL MANIFESTATIONS OF DEPLETION

Symptoms of vitamin K depletion or deficiency include: excessive bleeding, menorrhagia, bruises that form easily, or appearance of ruptured capillaries.

FOOD SOURCES

The best sources of Vitamin K1 are plant foods, especially dark green leafy vegetables. Note: the absorption of vitamin K1 from food is extremely low. Only 10 percent of the vitamin K, which is found in green leafy vegetables, is absorbed in your body. There’s no variable or modification of the consumption that will significantly increase the absorption.

SUPPLEMENT OPTIONS

Vitamin K is a group of fat-soluble vitamins. This group of vitamins includes two natural vitamins: vitamin K1 and vitamin K2. These Vitamins are structurally similar and their name comes from the German word 'klotting'. Vitamin K1, also known as phylloquinone, assists with blood clotting, supports the formation of bone and bone matrix, and aids in glucose to glycogen conversion for storage in the liver.

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Micronutrients - Summary

Micronutrient

Vitamins	Serum Current	Serum Previous	Serum Reference	Cellular Current	Cellular Previous	Cellular Reference
Vitamin K2	0.47		0.1-5.19 (ng/mL)	0.04		0.1-0.89 (pg/MM WBC)

PHYSIOLOGICAL FUNCTION

Vitamin K is a group of fat-soluble vitamins. This group of vitamins includes two natural vitamins: vitamin K1 and vitamin K2. Vitamin K2 is the main storage form of Vitamin K in animals. It has several forms, referred to as menaquinones. The nomenclature denoting vitamin K2 types will include an 'MK' to specify this is a menaquinone, and the number following this denotes how many isoprenyl units are on the side chain of the molecule. The most common forms are MK-4 and MK-7. Bacteria in the colon can convert K1 (from plant-based foods) into vitamin K2. Vitamin K2 is necessary to prevent arterial calcification, which it does by activating matrix GLA protein (MGP). This matrix GLA protein is present in blood vessels and inhibits soft tissue calcification. Matrix GLA protein needs to be carboxylated to work properly, and Vitamin K2-MK7 plays a major role in this carboxylation.

HOW IT GETS DEPLETED

Dietary deficiency of vitamin K1 is extremely rare unless there has been significant damage to the intestinal lining, such as in inflammatory bowel disorders (Crohn's, ulcerative colitis, etc), liver disease, cystic fibrosis, and fat malabsorption disorders. In addition, the use of oral blood-thinning medications and some antibiotics can interfere with vitamin K. Individuals with chronic kidney disease are at risk for vitamin K deficiency. Individuals with ApoE4 genotype may be at greater risk for low vitamin K. Since Vitamin K is a fat-soluble vitamin, following a chronically low-fat diet can inhibit absorption.

CLINICAL MANIFESTATIONS OF DEPLETION

Inadequate levels of both Vitamin K1 and K2 will radically increase risk for heart disease and stroke. Chronically low vitamin K levels can lead to uncontrolled bleeding and chronic marginally low vitamin K levels are correlated in some studies with osteoporosis. Because vitamin K2 also assists in calcium homeostasis, low or deficient levels of vitamin K2 can lead to unregulated calcium release from bone tissue sources in the presence of vitamin D3 supplementation. Supplementation of vitamin D2 does not tend to lead to this, however. It is recommended that vitamin K2 be supplemented when vitamin D3 is supplemented. Levels of K2 are inversely related to cardiovascular disease and coronary calcification.

FOOD SOURCES

The best sources of vitamin K2 include some fermented foods predominantly natto and some rare fermented cheeses, and liver. There are minor amounts present in egg yolk and butter.

SUPPLEMENT OPTIONS

Vitamin K is a group of fat-soluble vitamins. This group of vitamins includes two natural vitamins: vitamin K1 and vitamin K2. Vitamin K2 is the main storage form of Vitamin K in animals. It has several forms, referred to as menaquinones. The nomenclature denoting vitamin K2 types will include an 'MK' to specify this is a menaquinone, and the number following this denotes how many isoprenyl units are on the side chain of the molecule. The most common forms are MK-4 and MK-7. Bacteria in the colon can convert K1 (from plant-based foods) into vitamin K2. Vitamin K2 is necessary to prevent arterial calcification, which it does by activating matrix GLA protein (MGP). This matrix GLA protein is present in blood vessels and inhibits soft tissue calcification. Matrix GLA protein needs to be carboxylated to work properly, and Vitamin K2-MK7 plays a major role in this carboxylation.

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Micronutrients

Micronutrients

Fatty Acids: Omega-3 & 6		Current	Previous	Result	Reference
AA (Arachidonic acid)	Cellular	16.56		0 5.49 19.0	5.5-19.01 (%)
AA/EPA	Cellular	33.8		0 2.4 10.9	2.5-10.9
DHA	Cellular	4.51		0 2.41 10.5	2.42-10.52 (%)
DPA	Cellular	1.05		0 0.44 1.8	0.45-1.8 (%)
EPA	Cellular	0.49		0 0.14 2.26	0.15-2.26 (%)
LA (Linoleic acid)	Cellular	7.67		0 3.21 10.4	3.22-10.49 (%)
Omega-3 Index	Cellular	5.00		0 2.65 7.99 12.6	8.0-12.65 (%)
Total Omega-3	Cellular	6.93		0 3.24 13.9	3.25-13.99 (%)
Total Omega-6	Cellular	26.75		0 11.0 34.9	11.03-34.96 (%)

Amino Acids		Current	Previous	Result	Reference
Arginine	Serum	216.1		0 81.5 249	81.6-249.0 (nmol/mL)
Asparagine	Serum	71.4		0 39.1 89.8	39.2-89.8 (nmol/mL)
	Cellular	0.6		0 0.4 2.8	0.5-2.8 (ng/MM WBC)
Citrulline	Serum	28.6		0 18.6 47.5	18.7-47.5 (nmol/mL)
Glutamine	Serum	3.2		0 1.3 7	1.4-7.0 (ng/MM WBC)
Isoleucine	Serum	179.4		0 25.4 158	25.5-158.9 (nmol/mL)
Leucine	Serum	>250		0 101 249	101.2-249.3 (nmol/mL)
Serine	Serum	3.1		0 1.7 19.8	1.8-19.8 (ng/MM WBC)
Valine	Serum	261.7		0 155 368	155.9-368.0 (nmol/mL)

Minerals		Current	Previous	Result	Reference
Calcium	Serum	9.4		6.5 8.8 10.6	8.9-10.6 (mg/dL)
	Cellular	26		0 14 120	15.0-120.0 (ng/MM WBC)
Chromium	Serum	0.27		0 0.09 0.7	0.1-0.7 (ng/mL)

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Minerals		Current	Previous	Result	Reference
Copper	Serum	1.3		0 0.5 1.8	0.6-1.8 (mcg/mL)
	Cellular	2		0 1 15	2.0-15.0 (ng/MM WBC)
Copper to Zinc Ratio	Serum	2.2		0 0.8 2.6	0.9-2.6
Iron	Serum	98		0 58 158	59.0-158.0 (ug/dL)
	Cellular	107.3		0 88.8 117	88.9-117.0 (mg/dL)
Magnesium	Serum	2.2		1 1.5 2.6	1.6-2.6 (mg/dL)
	Cellular	4.4		0 3.5 7.7	3.6-7.7 (mg/dL)
Manganese	Serum	1.0		0 0.2 2	0.3-2.0 (ng/mL)
	Cellular	18		0 1 75	2.0-75.0 (pg/MM WBC)
Zinc	Serum	0.6		0 0.4 1	0.5-1.0 (mcg/mL)
	Cellular	7		0 3 15	4.0-15.0 (ng/MM WBC)

Metabolites		Current	Previous	Result	Reference
Carnitine	Serum	34.8		0 11.5 43.4	11.6-43.4 (nmol/mL)
	Cellular	0.6		0 0.2 1.5	0.3-1.5 (ng/MM WBC)
Choline	Serum	11.9		0 6.7 31	6.8-31.0 (nmol/mL)
	Cellular	0.3		0 0.1 1.5	0.2-1.5 (ng/MM WBC)
Inositol	Serum	29.4		0 20.4 60.7	20.5-60.7 (nmol/mL)
	Cellular	0.20		0 0.09 2.5	0.1-2.5 (ng/MM WBC)
MMA (Methylmalonic acid)	Serum	0.33		0 0.09 0.5	0.1-0.5 (nmol/mL)

Antioxidants		Current	Previous	Result	Reference
Coenzyme Q10	Serum	1.85		0 0.55 2.78	0.56-2.78 (µg/mL)
	Cellular	95.4		0 39.5 225	39.6-225.3 (pg/MM WBC)

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Micronutrients

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Antioxidants		Current	Previous	Result	Reference
Cysteine	Serum	40.8		0 3.3 37	3.4-37.0 (nmol/mL)
	Cellular	412.7		0 59.9 565	60.0-565.0 (pg/MM WBC)
Glutathione	Cellular	194.1		0 98.6 1163	98.7-1163.0 (pg/MM WBC)
Selenium	Serum	115.5		0 109 218	109.8-218.4 (ng/mL)
	Cellular	408		0 233 1050	234.0-1050.0 (pg/MM WBC)

Vitamins		Current	Previous	Result	Reference
Folate	Serum	>20		0 4.5	≥4.6 (ng/mL)
	Cellular	578.6		0 95.4	≥95.5 (ng/mL)
Vitamin A	Serum	72.0		0 40.7 154	40.8-154.5 (mcg/dL)
	Cellular	3.4		0 0.8 17.3	0.9-17.3 (pg/MM WBC)
Vitamin B1	Serum	1.7		0 1.3 71.3	1.4-71.3 (nmol/L)
	Cellular	0.24		0 0.09 7	0.1-7.0 (pg/MM WBC)
Vitamin B12	Serum	360		0 231 1245	232.0-1245.0 (pg/mL)
	Cellular	2.95		0 1.99 11.9	2.0-11.99
Vitamin B2	Serum	44.0		0 5.5 126	5.6-126.1 (mcg/L)
	Cellular	0.3		0 0.1 3.6	0.2-3.6 (pg/MM WBC)
Vitamin B3	Serum	6.4		0 2.5 36.1	2.6-36.1 (ng/mL)
	Cellular	59.7		0 39.5 303	39.6-303.5 (pg/MM WBC)
Vitamin B5	Serum	108.4		0 22.6 429	22.7-429.2 (mcg/L)
	Cellular	10.2		0 2.4 32.8	2.5-32.8 (pg/MM WBC)
Vitamin B6	Serum	9.3		0 2.7 76.2	2.8-76.2 (ng/mL)
	Cellular	2.2		0 0.4 9.7	0.5-9.7 (pg/MM WBC)

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Vitamins		Current	Previous	Result	Reference
Vitamin C	Serum	0.3		0 0.1 1.1	0.2-1.1 (mg/dL)
	Cellular	4.9		0 0.4 9.7	0.5-9.7 (ng/MM WBC)
Vitamin D, 25-OH	Serum	42.0		0 29.9 108	30.0-108.0 (ng/mL)
Vitamin D3	Serum	0.8		0 0.3 1.8	0.4-1.8 (ng/mL)
	Cellular	62.5		0 25.8 246	25.9-246.6 (pg/MM WBC)
Vitamin E	Serum	11.4		0 7.3 30.6	7.4-30.6 (mg/L)
	Cellular	176.8		0 18.3 1031	18.4-1031.1 (pg/MM WBC)
Vitamin K1	Serum	0.82		0 0.09 8.1	0.1-8.1 (ng/mL)
	Cellular	0.08		0 0.09 0.71	0.1-0.71 (pg/MM WBC)
Vitamin K2	Serum	0.47		0 0.09 5.19	0.1-5.19 (ng/mL)
	Cellular	0.04		0 0.09 0.89	0.1-0.89 (pg/MM WBC)

Electrolytes		Current	Previous	Result	Reference
Potassium	Serum	4.1		3 3.4 5.1	3.5-5.1 (mmol/L)
Sodium	Serum	141		125 135 145	136.0-145.0 (mmol/L)