

# Magnesium Deficiency - Part Two

So, let's just go into a few cases. I'm only going to do four or five of these because it's pretty straightforward.

Marker	Value	Functional Range	Lab Range
Glucose	90	75 - 90	65 - 99
Hemoglobin A1c	5.5	4.4 - 5.4	4.8 - 5.6
Uric Acid	3.8	3.2 - 5.5	2.5 - 7.1
BUN	11	13 - 18	6 - 20
Creatinine	0.79	0.85 - 1.1	0.57 - 1
BUN/Creatinine Ratio	14	9 - 23	8 - 20
Sodium	140	135 - 140	134 - 144
Potassium	4.1	4.0 - 4.5	3.5 - 5.2
Chloride	101	100 - 106	97 - 108
CO2	22	25 - 30	18 - 29
Calcium	9.0	9.2 - 10.1	8.7 - 10.2
Phosphorus	3.7	3.5 - 4.0	2.5 - 4.5
Magnesium	1.7	2.0 - 2.6	1.6 - 2.3
Protein, total	6.9	6.9 - 7.4	6.0 - 8.5
Albumin	4.2	4.0 - 5.0	3.5 - 5.5
Globulin	2.7	2.4 - 2.8	1.5 - 4.5
A/G ratio	1.6	1.5 - 2.0	1.1 - 2.5
Bilirubin, total	0.6	0.1 - 1.2	0.0 - 1.2
Alkaline Phosphatase	56	42 - 107	39 - 117
LDH	131	140 - 180	119 - 226
AST	19	10 - 30	0 - 40
ALT	16	10 - 22	0 - 32
GGT	22	0 - 28	0 - 60
TIBC	250	250 - 350	250 - 450
UIBC	173	150 - 375	131 - 425
Iron	77	85 - 135	27 - 159
Iron saturation	31	15 - 45	15 - 55
Ferritin	64	15 - 120	15 - 150
Vitamin B-12	652	450 - 2000	211 - 946
Vitamin D, 25-hydroxy	43.8	35 - 60	30.0 - 100.0
Cholesterol, total	155	150 - 250	100 - 199
Triglycerides	56	50 - 100	0 - 149
HDL	64	55 - 85	> 39
LDL	80	0 - 175	0 - 99
T. Chol / HDL Ratio	2.4	< 3	0 - 4.4
Triglycerides / HDL Ratio	0.88	< 2	< 3.8
CRP-hs	1.44	< 1.0	0.00 - 3.00
Homocysteine	6.1	< 7.0	0.0 - 15.0

The first patient is a 40-year-old female with a chief complaint of mood imbalance and fatigue, which are both symptoms of magnesium deficiency. Her serum magnesium was 1.7, and as we just reviewed at that level, there is a 90 percent chance that she is deficient. Note that her TSH is very low, but her thyroid hormones are normal. Thyroglobulin antibodies are elevated, so she had Hashimoto's. One study showed that patients who are hyperthyroid may have reduced magnesium levels. However, another study showed reduced levels of magnesium in hypothyroid patients, so I

don't think there is enough data to draw any conclusions here, but it does seem from these studies that magnesium metabolism may be disturbed in patients with dysregulated thyroid function.

Marker	Value	Functional Range	Lab Range
TSH	0.040	0.5 – 2.5	0.45 - 4.50
T4, total	5.8	6.0 – 12	4.5 - 12
T3 Uptake	27	28 - 35	24 - 39
T3, Total	98	100 – 180	71 - 180
T3, Free	2.8	2.5 - 4.0	2 - 4.4
T4, Free	1.01	1 - 1.5	0.82 - 1.77
Thyroid – TPO Ab	20		0 - 34
Thyroid – TGA	1.1		0 - 0.9
Copper	102		72 - 166
Zinc	112		56 - 134
Zinc / Copper Ratio	1.10	> 0.85	
Serum Methylmalonic Acid (MMA)	131	0 - 325	0 - 378
WBC	4.6	5.0 – 8.0	3.4 - 10.8
RBC	4.17	4.4 – 4.9	3.77 - 5.28
Hemoglobin	12.7	13.5 - 14.5	11.1 - 15.9
Hematocrit	36.9	37 - 44	34 - 46.6
MCV	89	85 – 92	79 - 97
MCH	30.5	27.7 – 32.0	26.6 - 33.0
MCHC	34.4	32 – 35	31.5 - 35.7
RDW	12.9	11.5 – 15.0	12.3 - 15.4
Platelets	167	150 – 415	150 - 379
Neutrophils	52	40 – 60	
Lymphocytes	38	25 – 40	
Monocytes	8	4.0 – 7.0	
Eosinophils	2	0.0 – 3.0	
Basophils	0	0.0 – 3.0	

Marker	Value	Functional Range	Lab Range
Glucose	93	75 – 90	65 - 99
Hemoglobin A1c	5.4	4.4 – 5.4	4.8 - 5.6
Uric Acid	3.6	3.2 - 5.5	2.5 - 7.1
BUN	16	13 – 18	6 - 24
Creatinine	1.04	0.85 – 1.1	0.57 - 1
Sodium	139	135 – 140	134 - 144
Potassium	5.3	4.0 – 4.5	3.5 - 5.2
Chloride	101	100 – 106	97 - 108
C02	25	25 – 30	18 - 28
Calcium	8.9	9.2 – 10.1	8.7 - 10.2
Phosphorus	4.0	3.5 – 4.0	2.5 - 4.5
Magnesium	1.8	2.0 – 2.6	1.6 - 2.6
Protein, total	6.5	6.9 – 7.4	6.0 - 8.5
Albumin	4.5	4.0 – 5.0	3.5 - 5.5
Globulin	2.0	2.4 – 2.8	1.5 - 4.5
A/G ratio	2.3	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.6	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	52	42 – 107	39 - 117
LDH	168	140 - 180	119 - 226
AST	33	10 - 30	0 - 40
ALT	18	10 - 22	0 - 32
GGT	19	0 - 28	0 - 60
TIBC	266	250 – 350	250 - 450
UIBC	138	150 - 375	150 - 375
Iron	128	85 – 135	35 - 155
Iron saturation	48	15 – 40	15 - 55
Ferritin	55	15 - 120	15 - 150
Cholesterol, total	174	150 – 250	100 - 199
Triglycerides	41	50 – 100	0 - 149
HDL	72	55 – 85	> 39
LDL	94	0 – 175	0 - 99
T. Chol / HDL Ratio	2.4	< 3	0 4.4
Triglycerides / HDL Ratio	0.57	< 2	< 3.8
TSH	2.610	0.5 – 2.5	0.45 - 4.50
T4, total	8.4	6.0 – 12	4.5 - 12
T3 Uptake	32	28 - 35	24 - 39
T3, Total	78	100 – 180	71 - 180
Vitamin D, 25-hydroxy	28.7	35 - 60	30.0 - 100.0

Marker	Value	Functional Range	Lab Range
WBC	5.8	5.0 – 8.0	3.4 - 10.8
RBC	4.63	4.4 – 4.9	3.77 - 5.28
Hemoglobin	14.8	13.5 - 14.5	11.1 - 15.9
Hematocrit	45	37 - 44	34.0 - 46.6
MCV	97	85 – 92	79 - 97
MCH	32.0	27.7 – 32.0	26.6 - 33.0
MCHC	32.9	32 – 35	31.5 - 35.7
RDW	13.4	11.5 – 15.0	12.3 - 15.4
Platelets	288	150 – 415	150 - 379
Neutrophils	50	40 – 60	
Lymphocytes	41	25 – 40	
Monocytes	6	4.0 – 7.0	
Eosinophils	2	0.0 – 3.0	
Basophils	1	0.0 – 3.0	
<b>Additional Tests:</b>			
T3, Free	2.4	2.5 - 4.0	2 - 4.4
T4, Free	1.66	1 - 1.5	0.82 - 1.77
CRP-hs	0.49	< 1.0	0.00 - 3.00
Homocysteine	6.8	< 9.0	0.0 - 15.0
Vitamin B-12	1022	450 – 2000	211 - 946
Copper	101		72 - 166
Zinc	72		56 - 134
Zinc / Copper Ratio	0.71	> 0.85	

The next patient is a 44-year-old female with chief complaint of digestive issues, bloating, and constipation, again definitely consistent with magnesium deficiency. Serum magnesium was 1.8. Using the cutoffs we talked about before, there is probably a 65 to 70 percent chance that she is deficient. Vitamin D is also low. TSH is borderline high, and free T3 is borderline low. Zinc-to-copper ratio is low, and potassium was a little high. She had SIBO, dysbiosis, fungal overgrowth, and parasites. The main issue here was probably inadequate intake, because 60 percent of women in her age group don't get enough, and GI malabsorption.

Marker	Value	Functional Range	Lab Range
Glucose	76	75 - 85	65 - 99
Hemoglobin A1c	5.3	4.4 - 5.4	4.8 - 5.6
Uric Acid	3.6	W: 3.2 - 5.5	2.5 - 7.1
BUN	16	13 - 18	6 - 20
<b>Creatinine</b>	<b>0.66</b>	<b>0.85 - 1.1</b>	<b>0.57 - 1.00</b>
Sodium	140	135 - 140	134 - 144
Potassium	4.1	4.0 - 4.5	3.5 - 5.2
Chloride	101	100 - 106	97 - 108
<b>C02</b>	<b>23</b>	<b>25 - 30</b>	<b>18 - 29</b>
Calcium	9.7	9.2 - 10.1	8.7 - 10.2
Phosphorus	4.1	3.5 - 4.0	2.5 - 4.5
<b>Magnesium</b>	<b>1.7</b>	<b>2.0 - 2.5</b>	<b>1.6 - 2.6</b>
Protein, total	7.0	6.9 - 7.4	6.0 - 8.5
Albumin	5.0	4.0 - 5.0	3.5 - 5.5
<b>Globulin</b>	<b>2.0</b>	<b>2.4 - 2.8</b>	<b>1.5 - 4.5</b>
<b>A/G ratio</b>	<b>2.5</b>	<b>1.5 - 2.0</b>	<b>1.1 - 2.5</b>
Bilirubin, total	0.5	0.1 - 1.2	0.0 - 1.2
Alkaline Phosphatase	78	42 - 107	39 - 117
LDH	143	140 - 180	119 - 226
AST	21	W: 10-30	0 - 40
ALT	20	W: 10-22	0 - 32
GGT	10	10 - 26	0 - 60
TIBC	333	250 - 350	250 - 450
UIBC	175	150 - 375	150 - 375
<b>Iron</b>	<b>158</b>	<b>85 - 135</b>	<b>35 - 155</b>
<b>Iron saturation</b>	<b>47</b>	<b>15 - 40</b>	<b>15 - 55</b>
Ferritin	72	W: 10-122	15 - 150
<b>Cholesterol, total</b>	<b>214</b>	<b>150 - 250</b>	<b>100 - 199</b>
Triglycerides	49	50 - 100	0 - 149
<b>HDL</b>	<b>92</b>	<b>55 - 85</b>	<b>&gt; 39</b>
<b>LDL</b>	<b>112</b>	<b>0 - 175</b>	<b>0 - 99</b>
Triglycerides / HDL Ratio	0.532	< 2	< 3.8
<b>TSH</b>	<b>0.433</b>	<b>0.5 - 2.5</b>	<b>0.450 - 4.500</b>
T4, total	6.0	6.0 - 12	4.5 - 12.0
T3 Uptake	31	W: 28-35	24 - 39
<b>T3, Total</b>	<b>77</b>	<b>100 - 180</b>	<b>71 - 180</b>
<b>Vitamin D, 25-hydroxy</b>	<b>28.3</b>	<b>35 - 60</b>	<b>30.0 - 100.0</b>
<b>WBC</b>	<b>3.7</b>	<b>5.0 - 8.0</b>	<b>3.4 - 10.8</b>
<b>RBC</b>	<b>4.13</b>	<b>4.4 - 4.9</b>	<b>3.77 - 5.28</b>
<b>Hemoglobin</b>	<b>13.4</b>	<b>W: 13.5-14.5</b>	<b>11.1 - 15.9</b>

	Value	Functional Range	Lab Range
Hematocrit	41.7	W: 37-44	34.0 - 46.6
MCV	101	85 - 92	79 - 97
MCH	32.4	27.7 - 32.0	26.6 - 33.0
MCHC	32.1	32 - 35	31.5 - 35.7
RDW	12.9	11.5 - 15.0	12.3 - 15.4
Platelets	223	150 - 415	150 - 379
Neutrophils	41	40 - 60	
Lymphocytes	49	25 - 40	
Monocytes	6	4.0 - 7.0	
Eosinophils	3	0.0 - 3.0	
Basophils	1	0.0 - 3.0	
B-12	758	450 - 2000	211 - 946
<b>Additional Tests:</b>			
CRP-hs	0.29		0.00 - 3.00
Homocysteine	4.4		0.00 - 15.0
Sed Rate (Westergren)			0 - 32
T3, Free			2.0 - 4.4
T4, Free			0.82 - 1.77
Thyroid Peroxide (TPO)			0 - 34
Thyroglobulin, Antibody			0.0 - 0.9
TGF-B1			344 - 2382

The next patient is a 28-year-old female with multiple symptoms daily ranging from joint and muscle aches to anxiety and depressed mood. She also had gut issues and incompletely treated SIBO with methane overproduction. Serum magnesium is 1.7, again, a 90 percent chance of deficiency. Also low vitamin D, borderline functional anemia with high MCV, and borderline low TSH. Again, probable cause here is GI malabsorption with SIBO and possibly inadequate intake.

Marker	Value	Functional Range	Lab Range
Glucose	140	75 - 85	65 - 99
Hemoglobin Alc	7.4	4.4 - 5.4	4.8 - 5.6
Uric Acid	6.4	W: 3.2 - 5.5	2.5 - 7.1
BUN	8	13 - 18	8 - 27
Creatinine	0.68	0.85 - 1.1	0.57 - 1.00
Sodium	137	135 - 140	134 - 144
Potassium	4.2	4.0 - 4.5	3.5 - 5.2
Chloride	96	100 - 106	97 - 108
CO2	25	25 - 30	18 - 29
Calcium	9.4	9.2 - 10.1	8.7 - 10.3
Phosphorus	3.9	3.5 - 4.0	2.5 - 4.5
Magnesium	1.7	2.0 - 2.5	1.6 - 2.6
Protein, total	7.3	6.9 - 7.4	6.0 - 8.5
Albumin	4.3	4.0 - 5.0	3.6 - 4.8
Globulin	3.0	2.4 - 2.8	1.5 - 4.5
A/G ratio	1.4	1.5 - 2.0	1.1 - 2.5
Bilirubin, total	0.3	0.1 - 1.2	0.0 - 1.2
Alkaline Phosphatase	89	42 - 107	39 - 117
LDH	165	140 - 180	119 - 226
AST	23	W: 10-30	0 - 40
ALT	30	W: 10-22	0 - 32
GGT	22	10 - 26	0 - 60
TIBC	369	250 - 350	250 - 450
UIBC	307	150 - 375	150 - 375
Iron	62	85 - 135	35 - 155
Iron saturation	17	15 - 40	15 - 55
Ferritin	222	MW 33-263	15 - 150
Cholesterol, total	210	150 - 250	100 - 199
Triglycerides	140	50 - 100	0 - 149
HDL	68	55 - 85	> 39
LDL	114	0 - 175	0 - 99
Triglycerides / HDL Ratio	2.05	< 2	< 3.8
TSH	0.948	0.5 - 2.5	0.450 - 4.500
T4, total	8.7	6.0 - 12	4.5 - 12.0
T3 Uptake	23	W: 28-35	24 - 39
T3, Total	136	100 - 180	71 - 180
Vitamin D, 25-hydroxy	24.7	35 - 60	30.0 - 100.0
WBC	9.6	5.0 - 8.0	3.4 - 10.8
RBC	4.68	4.4 - 4.9	3.77 - 5.28
Hemoglobin	13.4	W: 13.5-14.5	11.1 - 15.9

	Value	Functional Range	Lab Range
Hematocrit	39.5	W: 37-44	34.0 - 46.6
MCV	84	85 - 92	79 - 97
MCH	28.6	27.7 - 32.0	26.6 - 33.0
MCHC	33.9	32 - 35	31.5 - 35.7
RDW	14.3	11.5 - 15.0	12.3 - 15.4
Platelets	353	150 - 415	150 - 379
Neutrophils	56	40 - 60	
Lymphocytes	24	25 - 40	
Monocytes	7	4.0 - 7.0	
Eosinophils	13	0.0 - 3.0	
Basophils	0	0.0 - 3.0	
B-12	1715	450 - 2000	211 - 946
<b>Additional Tests:</b>			
CRP-hs	6.61		0.00 - 3.00
Homocysteine	5.7		0.00 - 15.0
Sed Rate (Westergren)			0 - 32
T3, Free	3.1		2.0 - 4.4
T4, Free	1.18		0.82 - 1.77
Thyroid Peroxide (TPO)	6		0 - 34
Thyroglobulin, Antibody	<1.0		0.0 - 0.9
TGF-B1			344 - 2382

The next patient is a 61-year-old female with chief complaint of type 2 diabetes, recurring cough, fatigue, dysthymic disorder, and weight gain. She fits the profile very well. Serum magnesium was 1.7, 90 percent chance of deficiency; low vitamin D; high triglycerides; borderline high ALT; and high CRP. Low magnesium may be contributing to metabolic issues for her.

Marker	Value	Functional Range	Lab Range
Glucose	89	75 - 90	65 - 99
Hemoglobin A1c	5.8	4.4 - 5.4	4.8 - 5.6
Uric Acid	5.5	3.7 - 6.0	3.7 - 8.6
BUN	14	13 - 18	6 - 20
Creatinine	0.86	0.85 - 1.1	0.76 - 1.27
BUN/Creatinine Ratio	16	8 - 19	8 - 19
Sodium	142	135 - 140	134 - 144
Potassium	4.1	4.0 - 4.5	3.5 - 5.2
Chloride	103	100 - 106	97 - 108
CO2	24	25 - 30	18 - 29
Calcium	9.3	9.2 - 10.1	8.7 - 10.2
Phosphorus	3.1	3.5 - 4.0	2.5 - 4.5
Magnesium	1.9	2.0 - 2.6	1.6 - 2.6
Protein, total	7.5	6.9 - 7.4	6.0 - 8.5
Albumin	4.4	4.0 - 5.0	3.5 - 5.5
Globulin	3.1	2.4 - 2.8	1.5 - 4.5
A/G ratio	1.4	1.5 - 2.0	1.1 - 2.5
Bilirubin, total	0.4	0.1 - 1.2	0.0 - 1.2
Alkaline Phosphatase	86	42 - 107	39 - 117
LDH	144	140 - 180	121 - 224
AST	24	10 - 30	0 - 40
ALT	36	10 - 29	0 - 44
GGT	27	0 - 40	0 - 65
TIBC	293	250 - 350	250 - 450
UIBC	240	150 - 375	150 - 375
Iron	53	85 - 135	40 - 155
Iron saturation	18	15 - 45	15 - 55
Ferritin	454	30 - 150	30 - 400
Cholesterol, total	205	150 - 240	100 - 199
Triglycerides	121	50 - 100	0 - 149
HDL	59	55 - 85	> 39
LDL	122	0 - 175	0 - 99
T. Chol / HDL Ratio	3.5	< 3	0 - 5.0
Triglycerides / HDL Ratio	2.05	< 2	< 3.8
TSH	4.100	0.5 - 2.5	0.450 - 4.500
T4, total	8.8	6.0 - 12	4.5 - 12
T3 Uptake	22	30 - 38	24 - 39
T3, Total	120	100 - 180	71 - 180
Vitamin D, 25-hydroxy	25.7	35 - 60	30.0 - 100.0

Marker	Value	Functional Range	Lab Range
WBC	7.3	5.0 – 8.0	3.4 - 10.8
RBC	5.01	4.4 – 4.9	4.14 - 5.8
Hemoglobin	14.5	14 - 15	12.6 - 17.7
Hematocrit	44.5	40 - 48	37.5 - 51.0
MCV	89	85 – 92	79 - 97
MCH	28.9	27.7 – 32.0	26.6 - 33.0
MCHC	32.6	32 – 35	31.5 - 35.7
RDW	13.8	11.5 – 15.0	12.3 - 15.4
Platelets	248	150 – 415	150 - 379
Neutrophils	51	40 – 60	
Lymphocytes	34	25 – 40	
Monocytes	6	4.0 – 7.0	
Eosinophils	9	0.0 – 3.0	
Basophils	0	0.0 – 3.0	

  

Additional Tests:			
T3, Free	3.1	2.5 - 4.0	2 - 4.4
T4, Free	1.12	1 - 1.5	0.82 - 1.77
Thyroid – TPO Ab	271		0 - 34
Thyroid – TGA	<1.0		0 - 0.9
CRP-hs	9.76	< 1.0	0.00 - 3.00
Homocysteine	10.6	< 7.0	0.0 - 15.0
Vitamin B-12	845	450 – 2000	211 - 946
Copper	115		72 - 166
Zinc	105		56 - 134
Zinc / Copper Ratio	0.91	> 0.85	
Serum Methylmalonic Acid (MMA)	59	0 - 325	0 - 378
Rheumatoid Arthritis Factor	28.3		0.0 - 13.9

The next patient is a 38-year-old male with chief complaint of psoriasis and joint pain, diagnosed with psoriatic arthritis. Serum magnesium was 1.9. At that cutoff, maybe a 30 percent chance of deficiency, but given symptoms and clinical picture, the fact that he may have prediabetes, I would do a therapeutic trial. He has low vitamin D, high ferritin, high hemoglobin A1c, borderline high triglycerides, high C-reactive protein, and high homocysteine. That all points to metabolic dysregulation. He also has Hashimoto's with high TPO antibodies and high TSH at 4.1. In this case, magnesium supplementation helped quite a bit with his blood sugar and arthritic symptoms.

Marker	Value	Functional Range	Lab Range
Glucose	85	75 – 90	65 - 99
Hemoglobin A1c	5.0	4.4 – 5.4	4.8 - 5.6
Uric Acid	5.1	3.2 - 5.5	2.5 - 7.1
BUN	6	13 – 18	6 - 24
Creatinine	0.68	0.85 – 1.1	0.57 - 1
BUN/Creatinine Ratio	9	9 – 23	9 - 23
Sodium	141	135 – 140	134 - 144
Potassium	4.6	4.0 – 4.5	3.5 - 5.2
Chloride	101	100 – 106	97 - 108
CO2	24	25 – 30	18 - 29
Calcium	9.6	9.2 – 10.1	8.7 - 10.2
Phosphorus	3.4	3.5 – 4.0	2.5 - 4.5
Magnesium	1.8	2.0 – 2.6	1.6 - 2.6
Protein, total	6.9	6.9 – 7.4	6.0 - 8.5
Albumin	4.5	4.0 – 5.0	3.5 - 5.5
Globulin	2.4	2.4 – 2.8	1.5 - 4.5
A/G ratio	1.9	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.6	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	49	42 – 107	39 - 117
LDH	153	140 - 180	119 - 226
AST	17	10 - 30	0 - 40
ALT	14	10 - 22	0 - 32
GGT	11	0 - 28	0 - 60
TIBC	255	250 – 350	250 - 450
UIBC	171	150 - 375	150 - 375
Iron	84	85 – 135	35 - 155
Iron saturation	33	15 – 45	15 - 55
Ferritin	59	MW: 30 - 150	15 - 150
Cholesterol, total	163	150 – 250	100 - 199
Triglycerides	54	50 – 100	0 - 149
HDL	53	55 – 85	> 39
LDL	99	0 – 175	0 - 99
T. Chol / HDL Ratio	3.1	< 3	0 - 4.4
Triglycerides / HDL Ratio	1.02	< 2	
TSH	1.070	0.5 – 2.5	0.450 - 4.500
T4, total	7.5	6.0 – 12	4.5 - 12.0
T3 Uptake	31	28 - 35	24 - 39
T3, Total	109	100 – 180	71 - 180
Vitamin D, 25-hydroxy	43.2	35 - 60	30.0 - 100.0

Marker	Value	Functional Range	Lab Range
WBC	6.8	5.0 – 8.0	3.4 - 10.8
RBC	4.51	4.4 – 4.9	3.77 - 5.28
Hemoglobin	13.7	13.5 - 14.5	11.1 - 15.9
Hematocrit	40.9	37 - 44	34.0 - 46.6
MCV	91	85 – 92	79 - 97
MCH	30.4	27.7 – 32.0	26.6 - 33.0
MCHC	33.5	32 – 35	31.5 - 35.7
RDW	12.5	11.5 – 15.0	12.3 - 15.4
Platelets	238	150 – 415	150 - 379
Neutrophils	72	40 – 60	
Lymphocytes	21	25 – 40	
Monocytes	6	4.0 – 7.0	
Eosinophils	1	0.0 – 3.0	
Basophils	0	0.0 – 3.0	
<b>Additional Tests:</b>			
CRP-hs	0.64	< 1.0	0.00 - 3.00
Homocysteine	10.0	< 7.0	0.0 - 15.0
Vitamin B-12	416	450 – 2000	211 - 946
Copper	87		72 - 166
Zinc	74		56 - 134
Zinc / Copper Ratio	0.85	> 0.85	
Serum Methylmalonic Acid (MMA)	185	0 - 325	0 - 378

The next patient is a 38-year-old female with chief complaint of frequent stomach aches, gas, bloating, belching after most meals, and a history of intermittent loose stools. Magnesium was 1.8, which is about a 60 percent chance of deficiency. B12 was on the low end, and homocysteine was on the high end, which is suggestive of possible B12, folate, or B6 deficiency. Otherwise, her blood work looked pretty good. She did have significant gut inflammation, SIBO, dysbiosis, fungal overgrowth, Blastocystis hominis, and gluten intolerance, and she was not on a gluten-free diet. Her magnesium intake was decent, but there was significant GI malabsorption here, which could explain the low levels.

Marker	Value	Functional Range	Lab Range
Glucose	76	75 - 85	65 - 99
Hemoglobin Alc	4.86	4.4 - 5.4	4.8 - 5.6
Uric Acid	4.72	W: 3.2 - 5.5	3.7 - 8.6
BUN	35	13 - 18	6 - 20
Creatinine	.72	0.85 - 1.1	0.76 - 1.27
Sodium	140	135 - 140	135 - 145
Potassium	4.7	4.0 - 4.5	3.5 - 5.2
Chloride	102	100 - 106	97 - 108
CO2		25 - 30	20 - 32
Calcium	10.16	9.2 - 10.1	8.7 - 10.2
Phosphorus	4.3	3.5 - 4.0	2.5 - 4.5
Magnesium	1.7	2.0 - 2.5	1.6 - 2.6
Protein, total	7.5	6.9 - 7.4	6.0 - 8.5
Albumin	5.16	4.0 - 5.0	3.5 - 5.5
Globulin	2.34	2.4 - 2.8	1.5 - 4.5
A/G ratio	2.21	1.5 - 2.0	1.1 - 2.5
Bilirubin, total	.4	0.1 - 1.2	0.0 - 1.2
Alkaline Phosphatase	57	27 - 90	25 - 150
LDH	185	140 - 180	0 - 225
AST	21	10 - 26	0 - 40
ALT	33	10 - 26	0 - 55
GGT	11	10 - 26	0 - 65
TIBC	301.67	250 - 350	250 - 450
UIBC		150 - 375	150 - 375
Iron	54.75	85 - 135	40 - 155
Iron saturation	22	15 - 40	15 - 55
Ferritin	106.8	W: 10-122	30 - 400
Cholesterol, total	371	150 - 250	100 - 199
Triglycerides	61	50 - 100	0 - 149
HDL	132.8	55 - 85	> 39
LDL	226	0 - 175	0 - 99
Triglycerides / HDL Ratio	.459	< 2	< 3.8
TSH	1.18	1.8 - 3.0	0.450 - 4.50
T4, total	7.17	6.0 - 12	4.5 - 12
T3 Uptake		W: 28-35	24 - 39
T3, Total	103.9	100 - 180	71 - 180
Vitamin D, 25-hydroxy	62.17	35 - 60	32 - 100
WBC	5.3	5.0 - 8.0	4.0 - 10.5
RBC	4.5	4.4 - 4.9	4.10 - 5.6
Hemoglobin	13.8	W: 13.5-14.5	12.5 - 17.0

	Value	Functional Range	Lab Range
Hematocrit	40.8	M: 40-48; W: 37-44	36 - 50
MCV	90.1	85 - 92	80 - 98
MCH	30.5	27.7 - 32.0	27 - 34
MCHC	33.9	32 - 35	32 - 36
RDW		11.5 - 15.0	11.7 - 15.0
Platelets	212	150 - 415	140 - 415
Neutrophils	60	40 - 60	40 - 74
Lymphocytes	35	25 - 40	14 - 46
Monocytes	2	4.0 - 7.0	4.0 - 13.0
Eosinophils	3	0.0 - 3.0	0.0 - 7.0
Basophils	0	0.0 - 3.0	0.0 - 3.0
B-12	1247	450 - 2000	211 - 946
<b>Additional Tests:</b>			
T4, Free	15.96		9.1 - 23
T3, Free	4.39		4 - 8.3

The last patient is a 35-year-old female with a chief complaint of infertility. Serum magnesium was 1.7, again, a 90 percent chance of deficiency. She had SIBO, hormone imbalance, and a number of other issues. After addressing those plus three months of magnesium supplementation, she was able to become pregnant.

## Recommended Dietary Allowance (RDA) for magnesium

Life Stage	Age	Males (mg/day)	Females (mg/day)
<b>Infants</b>	0-6 months	30 (AI)	30 (AI)
<b>Infants</b>	7-12 months	75 (AI)	75 (AI)
<b>Children</b>	1-3 years	80	80
<b>Children</b>	4-8 years	130	130
<b>Children</b>	9-13 years	240	240
<b>Adolescents</b>	14-18 years	410	360
<b>Adults</b>	19-30 years	400	310
<b>Adults</b>	31 years and older	420	320
<b>Pregnancy</b>	18 years and younger	-	400
<b>Pregnancy</b>	19-30 years	-	350
<b>Pregnancy</b>	31 years and older	-	360
<b>Breast-feeding</b>	18 years and younger	-	360
<b>Breast-feeding</b>	19-30 years	-	310
<b>Breast-feeding</b>	31 years and older	-	320

Reference: <http://lpi.oregonstate.edu/mic/minerals/magnesium>

Let's talk a little bit about magnesium repletion. Here is the U.S. RDA based on various population groups, and we'll have this for you as a handout. Remember, the RDA is not the amount needed for optimal health. It's the amount required to avoid acute deficiency symptoms. That said, as we saw before, a substantial number of patients are failing even to get this minimal amount, so I suggest about 500 mg per day for adult males and 400 mg per day for adult females and increasing the other minimums by a 20 percent safety margin.

## Highest dietary sources of magnesium

Food	Amount (mg per 200cal)
<b>Canned clams</b>	1,100
<b>Swiss chard, cooked</b>	860
<b>Purslane</b>	850
<b>Spinach, cooked &amp; raw</b>	756
<b>Beet greens, cooked &amp; raw</b>	636
<b>Kelp</b>	563
<b>Basil, fresh</b>	556
<b>Kale</b>	407
<b>Arugula</b>	376
<b>Okra, cooked</b>	327
<b>Chives, raw</b>	280
<b>Coconut water</b>	263

Here are the top sources of dietary magnesium, with once again shellfish topping the list, in this case, canned clams. With magnesium, you'll find it primarily in plant foods and also sea vegetables. We have chard, spinach, beet greens, kelp, basil, kale, arugula, okra, and then coconut water is a pretty good source of magnesium.

## Therapeutic dose of Mg: 200-600 mg/d

Even people on a nutrient-dense, healthy diet may need to supplement. If serum levels are low, you can give your patients a list of foods that are high in magnesium, but you should probably also give them supplements. The appropriate therapeutic dose depends on their background intake, but it can range from 200 to 600 mg per day. The Food and Nutrition Board of the Institute of Medicine set the tolerable upper intake limit from supplements at 350 per mg per day, and this was mostly due to a concern about GI side effects such as loose stool and diarrhea. People with kidney damage are at the greatest risk of toxicity such as lethargy, confusion, disturbances in normal cardiac rhythm, and deterioration of kidney function. This is mostly related to severe hypotension caused by excess magnesium. As hypermagnesemia progresses, you might see

muscle weakness and difficulty breathing. However, the Food and Nutrition Board also acknowledged that higher-dose supplementation may be warranted under medical supervision in patients without kidney damage, so this is where you can use these doses between 200 and 600 mg per day. I suggest retesting serum magnesium after 60 to 90 days, and you should see an increase in the serum magnesium concentration. Then you can drop to a maintenance dose of 200 to 250 mg per day.

Form	Indication
<b>Orotate</b>	Cardiovascular
<b>Glycinate</b>	Sleep and constipation
<b>Malate</b>	Energy and pain relief
<b>Taurate</b>	Blood sugar imbalances and anxiety
<b>Citrate</b>	Sleep and hard stools
<b>Oxide</b>	Poor bioavailability; causes loose stools
<b>Sulfate</b>	Not generally used in oral supplements; little evidence on topical absorption

For magnesium, different forms are best for different purposes. Orotate is best for cardiovascular issues. Glycinate is best for sleep and constipation. It has a calming effect, less of a laxative effect, but it still does promote motility. It has good bioavailability, since glycine is readily transported across the intestinal lumen, and it's good for chronic pain and muscle contraction.

Malate is good for energy and pain relief. It helps with ATP production and is used in fibromyalgia, chronic pain, and chronic fatigue syndrome. Taurate has effects on insulin sensitivity and a calming effect on neuromuscular excitability. It reduces blood pressure, stabilizes nerve cells, and it is antithrombotic. Magnesium oxide has poor bioavailability and can cause loose stools. Magnesium citrate, which is in some products such as Natural Calm, is rapidly absorbed, but it does have a stool-loosening effect, which may or may not be desirable.

Magnesium sulfate is not generally used in oral supplements. There is some in Epsom salts, and there is also some in these magnesium gel products, but there is not very much information about absorption or bioavailability there. Magnesium aspartate has increased bioavailability compared to

oxide and citrate, but it's not commonly found. It's used by some clinicians for chronic fatigue syndrome treatment. L-threonate improves brain and memory function. It's highly absorbable. There is not a lot of research on it yet. Magnesium picolinate, not a lot of research yet. Magnesium chloride is a transdermal form. There is no peer-reviewed research that I could find and not much evidence that magnesium can be absorbed through the skin, and, in fact, some evidence suggests that putting magnesium on the skin may actually improve skin barrier function, which means that it is not getting absorbed. Soaking in an Epsom salt bath may lead to some magnesium absorption, but it's almost certainly inferior to oral supplementation.

Okay, that's it for now. Thanks for watching. See you next time.