Correlating Micronutrient Testing with Common Pathologies

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Dr. Ron Grabowski is a practicing Doctor of Chiropractic in Houston, Texas. He has presented over 500 seminars and lectures on nutrition throughout the United States and in Europe, publishing several articles and a textbook in clinical nutrition.

Receiving his Bachelor of Science degree in Nutrition from North Dakota State University, he went on to be awarded his Doctor of Chiropractic degree from Texas Chiropractic College in Pasadena, Texas in 1989 where he became a professor and postgraduate diplomate lecturer. His dietitian experience includes tenure at some of the leading hospitals in the nation - The New York Hospital, Memorial Sloan Kettering in New York City (affiliated with Cornell Medical Center), Memorial Care System and the University of Texas M.D. Anderson Cancer Center in Houston, Texas.

Dr. Grabowski has served on the State of Texas Governor’s Childhood Obesity Taskforce and is a member of the American Dietetic Association, American Chiropractic Association and the Endocrine Society. In addition to his chiropractic practice, he has developed numerous vitamin and mineral formulas for supplement companies. Professional athletes, including those of Olympic standing, seek his expertise in nutrition consultation.

His research interests include nutritional support of the athlete and the use of supplements in clinical practice for the prevention and treatment of chronic diseases such as diabetes, heart disease, arthritis, fibromyalgia and gastrointestinal disorders.
Diabetes Mellitus

- Chromium
- Magnesium
- Vitamin D
- Zinc
- Niacinamide
Chromium

**Action:**

- Increasing the activation of Akt phosphorylation
  - Intracellular insulin-dependent protein that facilitates the uptake of glucose into cells.
  - Increases activation of the insulin receptor in the presence of insulin.
  - May reduce insulin requirement.
  - HbA1c (decreases have been similar to those seen with many oral hypoglycemic agents.
  - Mineral has shown to improve dyslipidemia in some diabetics.
  - Positive effects should be seen in 6 – 12 weeks.
Chromium – Adverse Effects

Nutrient/Nutrient Interaction

– Decreases zinc absorption
– Competes with iron for transport on transferrin.
– Vitamin C and aspirin may increase absorption.
Magnesium and Insulin

Intracellular magnesium

- Key role in regulating insulin action (mainly oxidative glucose metabolism).
- Insulin-mediated-glucose uptake.
- Reduced concentrations;
  - Result in defective tyrosine-kinase activity at the insulin receptor level.
    - Post binding
    - Influencing intracellular signaling and processing.

- Post-receptorial impairment in insulin action.
Magnesium Deficiency

• Possible underlying mechanism of insulin resistance.

  Arch Biochem Biophys (June, 2006)

• Low intake has been related to the development of type 2 DM.
Magnesium

• Insulin may modulate the shift of Mg from extracellular to intracellular space.

• May offset calcium-related excitation-contraction coupling and decrease smooth cell responsiveness to depolarizing stimuli.

• May be the missing link to the explanation of NIDDM and HTN.
Magnesium

- Dosage: 400 - 600 mg/day
- Low in Diabetes, especially with proliferative retinopathy.
- Intracellular magnesium levels were lower in patients with neuropathy.
- Important cofactor in glycolysis
- Elevated glucose levels increase excretion and utilization.
Magnesium

Evidence-based research

**Glycemic control** – An inverse relationship between plasma magnesium levels and indices of glycemic control in both Type 1 and 2.

**Insulin sensitivity** – diets low in magnesium are associated with increased insulin levels, and clinical magnesium deficiency is strongly associated with insulin resistance.
Type I Diabetes Mellitus and Vitamin D

• It was observed by Hypponen et al that children receiving 2000 IU vitamin D from age 1 on decreased their risk of getting type 1 diabetes by 80%.

Lancet 2001
Vitamin D and Insulin

• Vitamin D not only facilitates the biosynthetic capacity of β cells but also accelerates the conversion of proinsulin to insulin. (Diabetes Nutr Metab 2001)

• Vitamin D supplementation has been reported to improve insulin secretion in vitamin D–deficient and nondiabetic subjects and in patients with type 2 diabetes. Diabetologia 1986 and Bone Miner 1986

• Reports suggest that vitamin D deficiency affects β cell function and that vitamin D supplementation improves β cell function.
Zinc

- Alters fat and carbohydrate metabolism.
- Diabetics tend to hyperexcrete zinc.
- Important in wound healing.
- May protect beta-cells.
NIACININ (Niacinamide)

- Acts by protecting pancreatic B-cells from autoimmune destruction by maintaining intracellular NAD levels and inhibiting the enzyme (ADP-ribose) polymerase (PARP).
  - Enzyme involved in DNA repair
- May act as a weak antioxidant of nitric oxide radicals.
- Component of GTF
- May retard the development of nephropathy.
- Dosage: 25-50 mg/kg/day.
Thyroid Disorders

- Selenium
- Zinc
- Iron
- B-Vitamins
- Asparagine
Selenium and the Thyroid Gland

- Participates in the extrathyroidal deiodination of T4 to the active form T3 (Arthur et al. 1993).
- Component of deiodinase type I, which transforms T4 into T3 in liver, kidney, muscle and thyroid.
- Evidence suggests that deiodinases type II and Type III may also be selenium dependent (Arthur 1997).
- Deiodinase type II plays an important role in providing intracellular T3 to the brain and pituitary.
- Selenium also plays a role in oxidative stress control at the thyroid as a component of the enzyme glutathione peroxidase.
Zinc and the Thyroid Gland

- Protein synthesis
- Involved in T3 binding to its nuclear receptor (Miyamoto et al. 1991).

- In a zinc depletion-repletion study conducted in humans, Wada and King (1986) observed that circulating TSH, total T4 and free T4 tended to decrease during the depletion phase, returning to control levels after zinc repletion.

- Zinc deficiency can indirectly affect thyroid hormone status by decreasing energy intakes.
Iron and Thyroid

• The 2 initial steps of thyroid hormone synthesis are catalyzed by thyroperoxidases and are dependent on iron.
  ➢ Iodine incorporation into tyrosine residues of thyroglobulin and covalent bridging of the residues—are catalyzed by heme-containing thyroperoxidases.
  ➢ Theoretically, severe iron deficiency could lower thyroperoxidase activity and interfere with thyroid hormone synthesis.
• Animal and human studies suggest that iron deficiency impairs thyroid metabolism.
• Iron deficiency anemia decreases plasma thyroxine (T4) and triiodothyronine (T3) concentrations, reduces peripheral conversion of T4 to T3, and may increase concentrations of thyrotropin.
• Compared with healthy control subjects, iron-deficient adults have lower circulating T4 and T3 concentrations and higher thyrotropin concentrations.
Thyrotoxicosis and Vitamins

- Increases the need for almost all the vitamins especially pyridoxine, pantothenic acid, and thiamin.
  - A deficiency of pyridoxine in a normal animal depresses the uptake of radioactive iodine by the thyroid gland.
- If pyridoxine deficiency exists, gastric secretion decreases with a subsequent decline in vitamin B12 absorption.
- Mohamed and Roberts have reported that seven of ten thyrotoxic patients showed an abnormality in the breakdown of histidine to glutamic acid.
  - This reaction has been shown to be folate dependent and suggests that a relative deficiency of folic acid exists in the thyrotoxic patient.
- Excessive thyroid secretion has been demonstrated to increase the need for vitamin A, riboflavin, ascorbic acid, vitamin D, choline, and perhaps vitamin E.
Migraines

1. Vitamin B12
2. Magnesium
3. Pantothenic acid
4. CoQ10
5. Riboflavin
Vitamin B12

- Exerts a scavenging action against nitric oxide (NO).
  - NO has been shown to inhibit respiratory chain by binding to complex I & III, and cytochrome c oxidase.

- Homocysteine
  - Homocysteic acid
    - Excitotoxin
Magnesium and Migraines

• Current evidence suggests that up to 50% of migraine patients have lowered levels of ionized magnesium during acute attacks.

• Inhibit platelet aggregation.

• Serotonin receptors are altered.

• Nitric oxide synthesis and release are affected by magnesium status.

• Reduce the inflammatory eicosanoids.
Pantothenic acid

- Anti-stress vitamin
- Affects phospholipid membrane integrity.
- Commonly found deficient with Vitamin B12 deficiency.
Coenzyme Q10

Mitochondrial Relationship

- Proton-electron translocation in mitochondria.
- Protects mitochondria from oxidation.
- Plays a role in permeability transition of the inner mitochondrial membrane.
- Lowers serum lactate and pyruvate levels.
- > 50% reduction post 3 months
  - Dosage 150 mg/day
Riboflavin

FMN and FAD
- Electron transport chain
- Synergistic with NAD and NADP

Amitriptyline
- Increases the renal excretion of riboflavin.

(Pinto & Rivlin-1987)
Osteoporosis

- Calcium
- Magnesium
- Vitamin D
- Vitamin K
- Zinc
- Oleic acid
- Vitamin B12, Folic acid and B6
Magnesium and Osteoporosis

• On average, >60% of US men and women aged 20 y consume less than the dietary reference intake (DRI) for magnesium. (National Academy Press, 1997.)

• Serum magnesium is generally considered an unreliable indicator of magnesium nutritional status. (J Clin Chem Biochem 1980;18:257-70.)

• Conditions bone mineral crystal stability, largely by substitution of magnesium for calcium in surface positions of hydroxyapatite lattice.
Vitamin D

- Vitamin D deficiency - small intestine absorbs no more than 10-15% of dietary calcium.
- Vitamin D sufficiency, the small intestine absorbs, on average, 30% of dietary calcium; during growth, lactation, and pregnancy, the efficiency increases to 80%.
- Vitamin D deficiency in adults causes secondary hyperparathyroidism that can precipitate and exacerbate osteoporosis.

Vitamin K

• Nutritional vitamin K intake decreases substantially with age (Jie et al. 1995).
• Two vitamin K-dependent proteins not involved in hemostasis are osteocalcin or bone Gla protein (BGP) and matrix Gla protein (MGP).
• Osteocalcin is a low-molecular-weight protein (49-50 residues, depending upon species) containing three Gla residues that give the protein its mineral-binding properties (Price 1988).
Zinc and Osteoporosis

- Collagen synthesis and mineralization of bone.
- Synthesis of alkaline phosphatase.
- Augments the anabolic effect of insulin-like growth factor I on osteoblasts.

J Nutr (1982)
Peptides (1995)
Oleic Acid

• The alteration of the biochemical and biophysical membrane properties of the BLM (basolateral membranes) might play a role in the enhanced intestinal Ca and P absorption.

Comp Biochem Physiol A Physiol. 1996 Dec

• Deficiency on the MNT (Micronutrient Test) has been associated with low levels of the following nutrients:
  – Calcium
  – Vitamin D
  – Zinc
  – Copper
  – Magnesium
Vitamin B12/Folic acid/Pyridoxine

- Homocysteine elevations have been associated with osteoporosis.
- Stress fractures have been associated with Vitamin B12 deficiency.
Case Study #1

- 41 year old Female
- Medical history: Migraine headaches and Hypoglycemia
- **SpectraCell results:**
  - **Deficient:**
    - Glucose-insulin interaction
    - Chromium deficiency
    - Calcium deficiency
    - Magnesium deficiency
  - **Marginal value:**
    - CoQ10
Case Study #2

• 36 year old female
• Medical History: Hypothyroidism
• **SpectraCell results:**
  – **Deficient**
    • Zinc
    • Magnesium
    • Glucose-Insulin Interaction
    • Chromium
  – **Marginal**
    • Selenium
    • Oleic acid
Case Study #3

- 15 year old female
- Medical History: Chronic Migraine headaches, Anxiety and fatigue
- **SpectraCell results:**
  - **Deficient:**
    - Vitamin B12
    - Pantothenic acid
  - **Marginal:**
    - Vitamin D
Case Study #4

• 68 year old Male
• Medical History: Type 2 Diabetes mellitus with Neuropathy and Hepatitis

• Spectrox:
  – **Deficient:**
    • Vitamin D, Zinc, Vitamin B12, Choline, Glutathione and Abnormal Spectrox
  – **Marginal:**
    • Pantothenate and Alpha lipoic acid
Commonly asked questions

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