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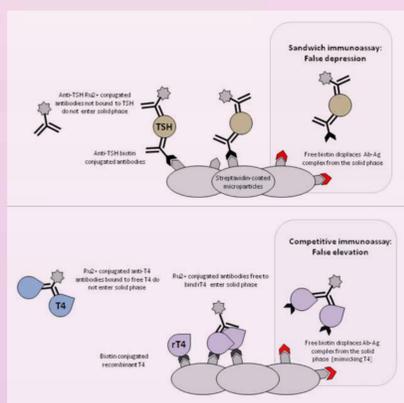
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# High Dose Biotin and its Effects on Thyroid Function Testing

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## INTRODUCTION

- ▶ Biotin, a water-soluble B vitamin, is used for the metabolism of carbohydrates, fats, and amino acids.
- ▶ Many laboratory tests that use biotin technology can be significantly altered in individuals taking high doses of biotin supplements (100-300mg/day).



Mechanism of biotin interference in Roche immunoassays. The Roche sandwich immunoassay employs a biotinylated antibody to the analyte (thyroid-stimulating hormone [TSH] in this example); therefore, excess free biotin displaces antigen-antibody complexes (Ab-Ag), which leads to less ruthenium (Ru2+)-conjugated antibody binding to the solid phase and false depression of analyte measurement. The Roche competitive immunoassay utilizes a complex of biotinylated analyte (thyroxine [T4] in this example) and microparticles with recombinant T4 (rT4) that displace the sample analyte being measured from an antibody-conjugate with Ru2+. Excess free biotin also displaces Ab-Ag complex from the solid phase, producing false elevations in sample analyte measurements.

## CASE PRESENTATION

- ▶ A 68-year-old Caucasian female with a history of multiple sclerosis on 300mg biotin daily presented with diarrhea, decreased appetite, and altered mental status.
- ▶ The patient had a temperature of 96.1°F on admission. Less than five hours later she was hypothermic with a temperature of 93.2°F. Her vitals at that time were a pulse of 69, respiratory rate of 14, SpO2 of 100% on room air, and a blood pressure of 129/65. On exam, she was lethargic and unable to follow commands.
- ▶ Lab studies revealed creatinine of 4.01mg/dL (baseline of 0.8mg/dL) and bicarbonate of 18 mmol/L (normal 23-31 mmol/L). Given her presentation, thyroid function tests (TFT) were ordered and resulted as TSH 0.02 uIU/mL (normal 0.36-3.74 uIU/mL) and free T4 greater than 8.00 ng/dL (normal 0.76-1.46 ng/dL).
- ▶ Repeat thyroid labs on day two showed TSH of 0.02 uIU/mL, free T3 of 1.86 pg/mL (normal 2.30-4.20 pg/mL), total T3 of 0.7ng/mL (normal 0.60-1.81 ng/mL), and total T4 of 7.2ng/dL (normal 4.5-10.9ug/dL). TPO autoantibody, thyroglobulin antibody, and thyroid stimulating immunoglobulin were negative.
- ▶ While the patient's labs were consistent with hyperthyroidism, she did not clinically examine thyrotoxic.
- ▶ Further history revealed that biotin had been started by her outpatient neurologist for multiple sclerosis and had been held upon admission. The patient's use of high dose 300mg biotin daily for multiple sclerosis was suspected to be the cause of the abnormal thyroid function tests.
- ▶ Repeat free T4, on hospital day three, was 6.2 ng/dL. On hospital day four, free T4 normalized to 1.37 ng/dL with no intervention.
- ▶ After treatment with IV fluids for acute kidney injury and discontinuing sedating medications, her clinical condition improved.

## DISCUSSION

- ▶ Our unique case illustrates the importance of understanding how medications and supplements can alter laboratory assays leading to test result errors. The lab studies consistent with severe thyrotoxicosis were confounded by an inconsistent clinical presentation in our patient.
- ▶ Biotin, an easily accessible supplement, is being increasingly used in high doses as a part of the pharmacological management of multiple sclerosis.
- ▶ The literature has demonstrated that when using the Roche assay for TFT measurement, biotin can falsely elevate free T4 and falsely lower the TSH. Biotin interferes with the sandwich assay used for TSH measurement as well as the competitive immunoassay used for T4 measurement.
- ▶ A high clinical suspicion of the degree of interaction between high dose biotin and TFT lab analysis is key. Our case exemplifies the importance of interpreting laboratory data with caution and clinically correlating it to each patient's unique presentation.

	7/7/19	7/8/19	7/9/19	7/10/19	Reference Range
TSH	0.02	0.02			0.36-3.74 uIU/mL
Free T4	>8.00	>8.00	6.20	1.37	0.76-1.46 ng/dL

Thyroid Laboratory Results after Biotin was Stopped