Biotin Interference:
The Impact is Coast to Coast

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Disclosure Statement

This Speaker Program is sponsored by, and on behalf of, Abbott and the content of the presentation is consistent with all applicable FDA requirements.

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Objectives

- Describe the use and prevalence of biotin use
- Describe the mechanism of biotin interference
- Understand biotin pharmacokinetics
- Explain my laboratory's experience with biotin use.
- Consider possible strategies to reduce or eliminate the risk of biotin interference.

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What is Biotin?

- Biotin is a water-soluble B vitamin, also called vitamin B_7 and formerly known as vitamin H or coenzyme R.It is involved in a wide range of metabolic processes, both in humans and in other organisms, primarily related to the utilization of fats, carbohydrates, and amino acids.

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Health Benefits of Biotin

- Biotin is used to enhance the overall health of hair, skin and nails [1,2]
- Biotin has also been recommended for conditions such as:
  - fetal development (3)
  - multiple sclerosis (4)
  - Diabetes (5,6)
  - Hyperlipedemia (5)
  - Alopecia (6)
  - Onychorrhexis (brittle nails) (1,6)
  - Dermatitis (6)
  - Depression (6)
  - Basal ganglia disease (Parkinsonism) (30,7)
  - Metabolic acidosis (8)
  - Peripheral neuropathy (15)
- Current daily doses range from 5 mg to 600 mg [7]
- No adverse side affects have been experienced with biotin even at high doses [7].

1. Hochman L.G. et al. Cutis 1993; 51 (4) : 303-305
2. Zempleni J and Kuroishi T. Adv Nutr. 2012;3:213-214.
3. Combs GF. Biotin. In: Combs, GF. The Vitamins: Fundamental Aspects in Nutrition and Health. San Diego, CA: Elsevier, Inc.; 2008: 331-344.
4. Sedel F et al. Mult Scler Relat Disord 2015; 4: 159-69.
5. Fernandez-Mejia C. Journal of Nutritional Biochemistry 2005; 16: 424– 4276.
6. Kummer S et al. New England Journal of Medicine 2016; 375 (17): 1699
7. Peyro Saint Paul L, et al. 2016; Expert Opinion on Drug Metabolism & Toxicology, 12:(3), 327-344.
8. Yudkoff M. Biotin Metabolism. In: Siegel GJ, Agranoff BW, Albers RW, et al., editors. Basic Neurochemistry: Molecular, Cellular and Medical Aspects. 6th edition. Philadelphia: Lippincott-Raven; 1999. Available from: https://www.ncbi.nlm.nih.gov/books/NBK28072/
15. Meany D. L. et al. Clinical Chemistry 2009; 55(9): 1737–1741
25. Kummer S et al. New England Journal of Medicine 2016; 375 (7): 704-706

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Supplement Use Has Increased in Recent Years

300% Growth in Biotin Retail Volume in the Recent Years

Biotin Monthly Retail Volume (2013–2016)

- **Nielsen Data** – **300 million** biotin capsules are sold monthly
- **Google Analytics** – **threefold increase** in biotin shopping searches
- Biotin is **Amazon's #1** Supplement Seller
  - Capsules with **5 to 10 mg** of biotin represent current supplement formulations

9. Nielsen FDM Data on Biotin Monthly Volume (Ending 03/26/16)
32. Amazon Best Sellers in Vitamin Supplements (Generated July19 2018)

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Supplement Facts

Serving Size 3 Softgels
Servings Per Container 83

Amount Per Serving		%Daily Value
Calories	15	
Calories from Fat	5	
Total Fat	1 g	2%**
Vitamin A (as Retinyl Palmitate)	5,000 IU	100%
Vitamin C (as Ascorbic Acid)	60 mg	100%
Vitamin D (as D3 Cholecalciferol)	800 IU	200%
Vitamin E (as d-Alpha Tocopheryl Acetate)	15 IU	50%
Thiamin (Vitamin B-1) (as Thiamin Mononitrate)	5 mg	333%
Riboflavin (Vitamin B-2)	5 mg	294%
Niacin (as Niacinamide)	25 mg	125%
Vitamin B-6 (as Pyridoxine Hydrochloride)	5 mg	250%
Folic Acid	200 mcg	50%
Vitamin B-12 (as Cyanocobalamin)	8 mcg	133%
Biotin (as d-Biotin)	5,000 mcg	1,667%
Pantothenic Acid (as d-Calcium Pantothenate)	15 mg	150%
Iron (as Ferrous Gluconate)	3 mg	17%
Zinc (as Zinc Gluconate)	7.5 mg	50%
Selenium (as Selenium Yeast)	12.5 mcg	18%
Manganese (as Manganese Gluconate)	5 mg	250%
Argan Oil *(Argania spinosa)*	25 mg	***
PABA (Para-Aminobenzoic Acid)	10 mg	***
Choline Bitartrate	10 mg	***
Alpha Lipoic Acid	10 mg	***
Horsetail *(Equisetum arvense)* (aerial)	3 mg	***
Hydrolyzed Collagen	50 mg	***
Hyaluronic Acid (as Sodium Hyaluronate)	30 mg	***

**Percent Daily Values are based on a 2,000 calorie diet.
***Daily Value not established.

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Supplement Facts

Serving Size 2 softgels
Servings Per Container 30

Amount Per Serving		% Daily Value
Calories	10	
Calories from Fat	10	
Total Fat	1 g	2%
Thiamin (vitamin B1)(as thiamine mononitrate)	10 mg	667%
Riboflavin (vitamin B2)	10 mg	588%
Niacin (as niacinamide)	40 mg	200%
Vitamin B6 (as pyridoxine hydrochloride)	10 mg	500%
Folic Acid	400 mcg	100%
Vitamin B12 (as cyanocobalamin)	20 mcg	333%
Biotin (as d-Biotin)	2,000 mcg	667%
Pantothenic Acid (as calcium d-pantothenate)	20 mg	200%
Proprietary Men's Hair Support Blend	1,566 mg (1.56 g)	*
providing:		
MSM (methylsulfonylmethane)		*
Saw Palmetto Extract (*serenoa repens*) (berry) (85% to 95% free fatty acids)		*
Pumpkin Seed Oil		*
Horsetail Extract (7% silica)(stem)		*
DIM (Diindolylmethane)		*
Food Complex (broccoli extract, cauliflower extract, brussel sprouts)		*

* Daily Value not established.

Other Ingredients: Gelatin, rice bran oil, glycerin, sunflower lecithin, beeswax, purified water, caramel color. 100% bovine gelatin, BSE-free.

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Bayer HealthCare
Consumer Care

ONE A DAY®
Women's

Directions: Adults: One tablet daily, with food.

Supplement Facts

Serving Size: One tablet

	Amount Per Serving	% Daily Value
Vitamin A (10% as beta-carotene)	700 mcg	78%
Vitamin C	75 mg	83%
Vitamin D (as Vitamin D_3)	25 mcg (1000 IU)	125%
Vitamin E	7.5 mg	50%
Vitamin K	25 mcg	21%
Thiamin (B_1)	1.2 mg	100%
Riboflavin (B_2)	1.3 mg	100%
Niacin	16 mg	100%
Vitamin B_6	1.7 mg	100%
Folate	666 mcg DFE (400 mcg folic acid)	167%
Vitamin B_{12}	6 mcg	250%
Biotin	1000 mcg	3333%
Pantothenic Acid	5 mg	100%
Calcium (elemental)	380 mg	29%
Iron	18 mg	100%
Iodine	150 mcg	100%
Zinc	8 mg	73%
Selenium	27.5 mcg	50%
Copper	0.9 mg	100%
Manganese	1.8 mg	78%
Chromium	25 mcg	71%

INGREDIENTS: Calcium Carbonate, Microcrystalline Cellulose, Dicalcium Phosphate, Ascorbic Acid, Ferrous Fumarate, Maltodextrin; Less than 2% of: Beta-Carotene, Biotin, Cholecalciferol, Chromium Chloride, Croscarmellose Sodium, Cupric Oxide, Cyanocobalamin, D-Calcium Pantothenate, dl-Alpha-Tocopheryl Acetate, FD&C Blue #2 Aluminum Lake, FD&C Yellow #5 (tartrazine) Aluminum Lake, FD&C Yellow #6 Aluminum Lake, Folic Acid, Gelatin, Hydroxypropyl Methylcellulose, Magnesium Oxide, Manganese Sulfate, Niacinamide, Phytonadione, Polyethylene Glycol, Potassium Iodide, Pyridoxine Hydrochloride, Riboflavin, Silicon Dioxide, Sodium Selenite, Stearic Acid, Thiamine Mononitrate, Titanium Dioxide (color), Vitamin A Acetate, Zinc Oxide.

WARNING: Accidental overdose of iron-containing products is a leading cause of fatal poisoning in children under 6. Keep this product out of reach of children. In case of accidental overdose, call a doctor or poison control center immediately.

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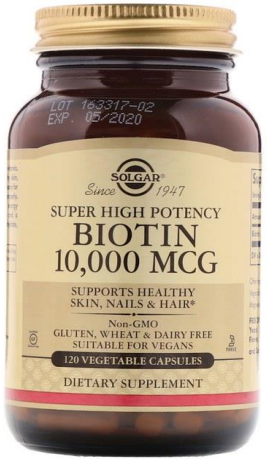

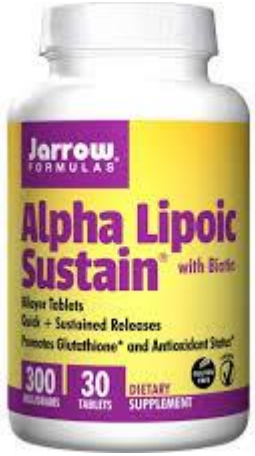

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Biotin Interference from Massachusetts General Hospital
(seen with Roche & Beckman Thyroid assays)

THYROID
Volume 26, Number 6, 2016

DOI: 10.1089/thy.2015.0664

CASE STUDIES, and PATIENTS WITH REMARKABLE FEATURES OR RARE DISORDERS

Misdiagnosis of Graves' Disease with Apparent Severe Hyperthyroidism in a Patient Taking Biotin Megadoses

Giuseppe Barbesino

Thyroid Unit, Massachusetts General Hospital-Harvard Medical School, Boston, Massachusetts.

TABLE 1. TEST RESULTS, DESIGN, AND NAMES IN THE CASE DESCRIBED

	Test results				
Test	*On biotin*	*Off biotin*	*Reference range*	*Assay design*	*Method*
Free thyroxine (ng/dL)	>7.8	1.4	0.9–1.8	Competitive[a]	Elecsys FT4 II, Roche
Total triiodothyronine (ng/dL)	>650	160	60–181	Competitive[a]	Elecsys T3, Roche
Thyrotropin (μIU/mL)	0.02	0.78	0.4–5.0	Sandwich[a]	Elecsys TSH, Roche
TSH binding inhibiting antibody (IU/L)	36	<1	<1.75	Competitive[a]	Elecsys TSHR, Roche
Thyroid stimulating antibody	<140%	<140%	<140%	*In vitro* bioassay	Thyretain, Quidel
Thyroglobulin (ng/mL)	3.9	21	<33	Sandwich[a]	Access Thyroglobulin, Beckman Coulter
Thyroglobulin antibody	<1	<1	<4	Sandwich[a]	Access Thyroglobulin Antibody II, Beckman Coulter
Sex hormone binding globulin (nmol/L)	65	56	19–76	Sandwich[a]	SHBG Roche

[a]Assays in which the streptavidin–biotin interaction is employed in the formation of a solid phase.

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13. Barbesino G. Thyroid. 2016; 26 (6): 860-863

Biotin Interference Publication from Cleveland Clinic

(seen with Roche PTH Assay)

FALSELY LOW PARATHYROID HORMONE SECONDARY TO BIOTIN INTERFERENCE: A CASE SERIES

Abhijeet Waghray, MD[1]; Mira Milas, MD[1]; Kavita Nyalakonda, MD[2]; Allan E. Siperstein, MD[1]

From the [1]Endocrine Surgery Department and the [2]Endocrinology Department, Endocrinology and Metabolism Institute, Cleveland Clinic, Cleveland, Ohio.

Case 1

A 60-year-old female with a history of pathological femoral and fibular neck fractures, osteopenia, and chronic renal insufficiency in the setting of renal artery stenosis was evaluated for primary hyperparathyroidism. Over 1 year, her PTH ranged from 90-336 pg/mL (reference range: 10-60 pg/mL), her calcium progressively increased from 10.3 to 11.5 mg/dL (reference range: 8.5 to 10.2 mg/dL), and a low 25-hydroxyvitamin D of 27 ng/mL (reference range: 31-80 ng/mL) was documented. Interestingly, blood work performed as the patient was being worked up in preparation for surgery showed that PTH became undetectable, although calcium remained elevated. In retrospect, it was found that this anomaly was due to her daily 1,500-mcg intake of biotin for hair growth. After the biotin was stopped, the test was repeated a month later and showed a PTH level of 197 pg/mL. To confirm the profound affect biotin had on the PTH level, the patient was restarted on biotin, and the PTH level was once again undetectable.

Case 2

A 62-year-old female was evaluated for a history of intermittently elevated calcium levels for the last 10 years with resultant kidney stones and more recently myalgias. On presentation, her calcium was 11.1 mg/dL and PTH was 82 pg/mL—levels consistent with primary hyperparathyroidism. One week after a subtotal parathyroidectomy, her PTH was 21 pg/mL and serum calcium was 9.9 mg/dL, demonstrating remnant parathyroid tissue function. Routine 6- and 9-month postoperative PTH levels were undetectable, with serum calcium levels of 9.6 and 9.3 mg/dL, respectively. Upon further investigation, it was found that the patient was taking 5,000 mcg of biotin for neuropathic pain.

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12. Waghray A et al. Endocr Pract. 2013; 19: 451-455

Biotin Interference Publication from Johns Hopkins

(seen with Roche PTH assay)

Clinical Chemistry 55:9
1737–1741 (2009)

Clinical Case Study

A Case of Renal Osteodystrophy with Unexpected Serum Intact Parathyroid Hormone Concentrations

Danni L. Meany,[1] Suzanne M. Jan de Beur,[2] Mary Jo Bill,[1] and Lori J. Sokoll[1*]

CASE

A 64-year-old female with long-standing end-stage renal disease (ESRD),[3] status post 2 failed renal transplants, was evaluated for management of renal osteodystrophy with particular concern for adynamic bone disease (ABD). ABD was suspected because of low normal serum intact parathyroid hormone (PTH) concentrations (range 2.5–54 ng/L, reference range 10–65 ng/L), intermittently increased serum calcium concentrations (range 88–107 mg/L, reference range 84–105 mg/L), and severe osteoporosis. However, her mildly increased serum alkaline phosphatase activities (range 149–196 U/L, reference range 30–120 U/L) were inconsistent with the low bone turnover observed in ABD. This discrepant clinical profile prompted investigation into the PTH assay used at our institution. Simultaneous samples were analyzed for intact PTH on our Roche Elecsys 2010 immunoassay analyzer and at a reference laboratory (Quest Diagnostics) on the Siemens Immulite 2000 immunoassay analyzer. Discrepant values of 48 and 786 ng/L were obtained, respectively.

Further review of the patient's medical history revealed that she was ingesting 10 mg biotin per day for restless leg syndrome and had been doing so for at least the past 2 years.

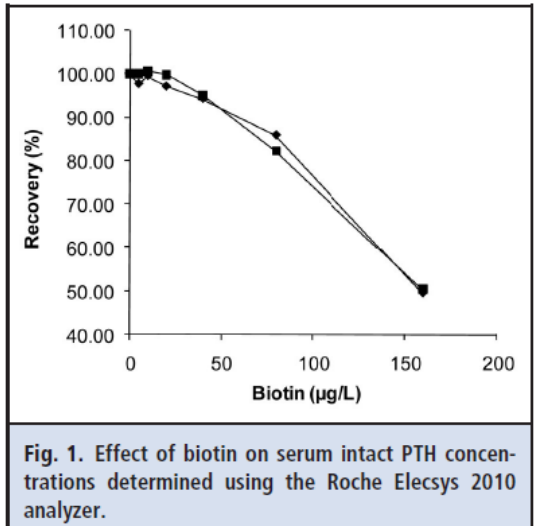

Fig. 1. Effect of biotin on serum intact PTH concentrations determined using the Roche Elecsys 2010 analyzer.

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15. Meany D. L. et al. Clinical Chemistry 2009; 55(9): 1737–1741

Biotin Interference Publication in *New England Journal of Medicine*

Biotin Treatment Mimicking Graves' Disease

Table 1. Characteristics of Six Children with Biotin-Induced Laboratory Indications of Autoimmune Hyperthyroidism.*

Variable	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Sex	Female	Female	Male	Male	Male	Male
Age	9 yr	2 yr	2 yr	5 mo	1 mo	1 mo
Primary disease	BTBGD	BTBGD	BTBGD	Infantile mitochondrial disease	Neonatal mitochondrial disease	Neonatal mitochondrial disease
Biotin dose (mg/kg/day)	10	14	15	2	7	8
Concomitant medication	Thiamine	Thiamine, methimazole, cholecalciferol, levetiracetam, chloral hydrate	Thiamine, methimazole, oxcarbazepine	Thiamine, sodium phenylbutyrate, propranolol, nystatin, cholecalciferol	CoQ10, thiamine, cholecalciferol, carnitine, riboflavin, bisoprolol, aspirin, furosemide	CoQ10, thiamine, methimazole, cholecalciferol, carnitine, riboflavin
Laboratory results						
During biotin treatment						
Thyrotropin (μIU/ml)	0.05	0.02	0.04	0.02	0.08	0.03
Free T_4 (ng/dl)	6.24	>7.77	>7.77	>7.77	>7.77	>7.77
Anti–thyrotropin receptor antibodies (IU/liter)	38.6	>40.0	>40.0	>40.0	>40.0	>40.0
Total T_3 (ng/dl)	>6.5	ND	>6.5	>6.5	>6.5	ND
1–7 Days after discontinuation of biotin						
Thyrotropin (μIU/ml)	1.80	3.75	6.07	2.20	8.12	2.87
Free T_4 (ng/dl)	1.58	1.70	1.16	1.13	1.84	1.91
Anti–thyrotropin receptor antibodies (IU/liter)	<0.3	ND	0.7	1.0	0.4	<0.3
Total T_3 (ng/dl)	2.0	ND	1.8	ND	1.8	2.3
Antithyroid medication	No	Methimazole treatment for 14 mo with up to 1.9 mg/kg/day†	Methimazole treatment for 3.5 mo with up to 0.9 mg/kg/day‡	No	No	Methimazole treatment for 2 wk

25. Kummer S et al. New England Journal of Medicine 2016; 375 (7): 704-706

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Biotin Interference with Several Other Assays

Table 1. Biotin Interference with Streptavidin–Biotin Immunoassays Leading to Falsely High Results in Competitive Formats and Falsely Low Results in Sandwich Formats.*

Test	Biotin-Affected Assay		Non–Biotin-Affected Assay	
	Result	Normal Reference Interval, Adults	Result	Normal Reference Interval, Adults
Competitive immunoassays				
Free thyroxine (pmol/liter)	>100.0†	12.0–22.0	11.3	9.0–19.0
Free triiodothyronine(pmol/liter)	17.3†	3.2–6.4	4.5	2.6 –6.0
Testosterone (nmol/liter)	42.9†	9.9–27.8	10.1	9.5–28.0
Estradiol (pmol/liter)	740†	<160	73	<160
Progesterone (nmol/liter)	125.4†	<4.3	0.4	<4.1
DHEA sulfate (μmol/liter)	>27.1†	1.2–9.0	6.6	3.0–16.0
Vitamin B_{12} (pmol/liter)	>1400†	200–700	380	135–650
Sandwich immunoassays				
Thyrotropin (mU/liter)	0.02‡	0.50–5.50	1.30	0.40–4.00
Prostate-specific antigen (ug/liter)	0.04‡	0.25–3.00	0.60	0.25–3.00
Parathyroid hormone (pmol/liter)	0.6‡	1.6–6.9	2.8	1.6–6.9
Luteinizing hormone (IU/liter)	0.2‡	1.7–8.6	1.4	1.1–8.8
Follicle-stimulating hormone (IU/liter)	0.4‡	1.5–12.4	8.5	1.0–12.0

* DHEA denotes dehydroepiandrosterone.
† Results are falsely high owing to biotin interference.
‡ Results are falsely low owing to biotin interference.

20. Trambas C. M. et al. New England Journal of Medicine 2016; 375 (17): 1698

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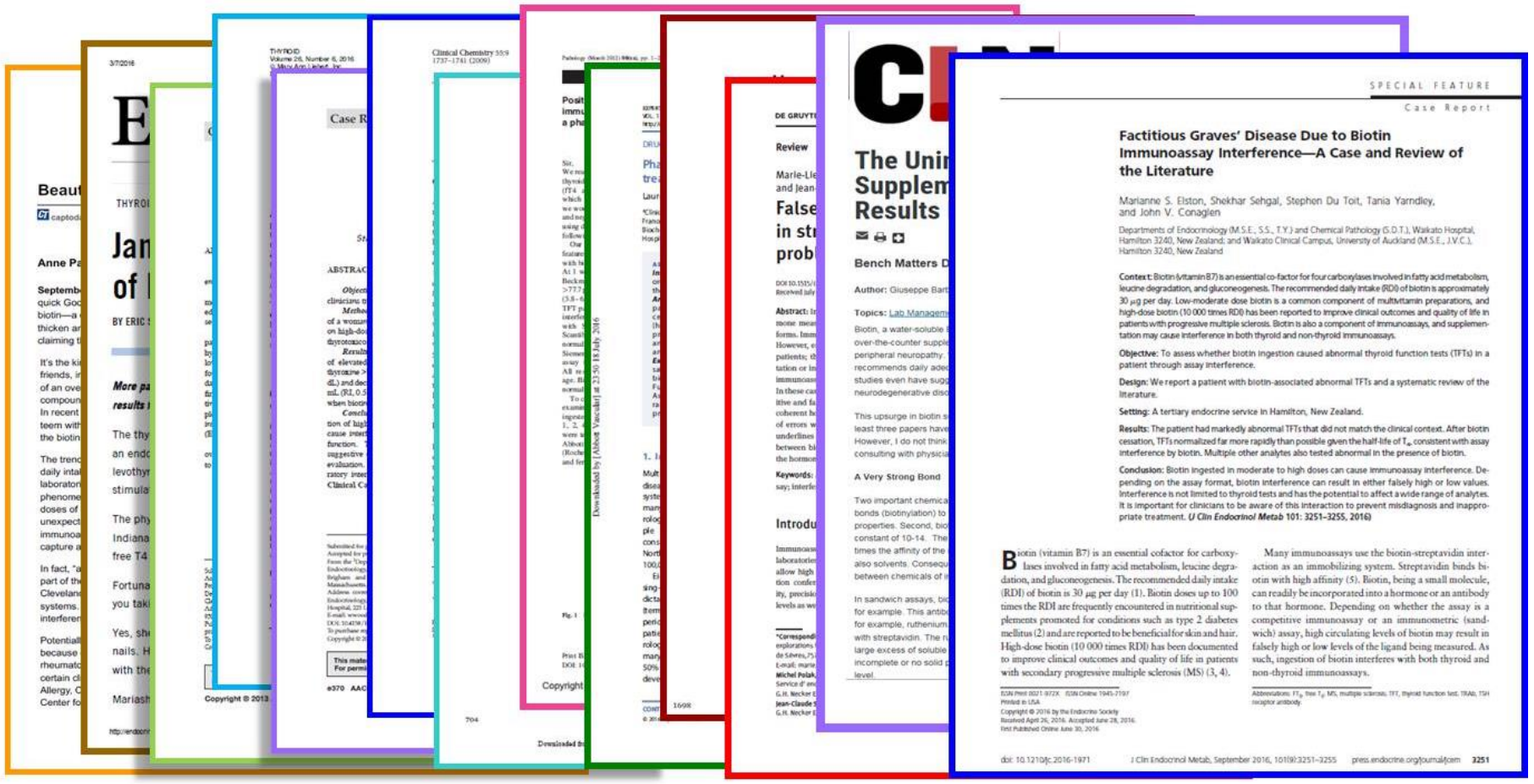
Biotin Interference on Patient Laboratory Test Results



10. Paxton A. CAP Today, September 20, 2016.
11. Seaborg, E. January 2016: Thyroid Month: Beware of Biotin, Endocrine News, 2016
12. Waghray A et al. Endocr Pract. 2013; 19: 451-455
13. Barbesino G. Thyroid. 2016; 26 (6): 860-863
14. Minkovsky A et al. AACE) Clinical Case Reports 2016; 2: e370-e373.
15. Meany D. L. et al. Clinical Chemistry 2009; 55(9): 1737–1741
6. Kummer S et al. New England Journal of Medicine 2016; 375 (7): 704-706
17. Wijeratne N.G., Doery, J.C.G and Lu, Z.X. Pathology. 2012; 44(7):674-975
7. Peyro Saint Paul L et al. Expert Opin on Drug Metab & Toxicol, 2016; 12:(3), 327-344
19. Elston M.S. et al. J Clin Endocrinol Metab 2016; 101: 3251–3255.
20. Trambas C. M. et al. New England Journal of Medicine 2016; 375 (17): 1698
21. Piketty ML et al. Clin Chem Lab Med. 2016 Oct 12.
22. Barbesino G. Clinical laboratory News, December, 2016

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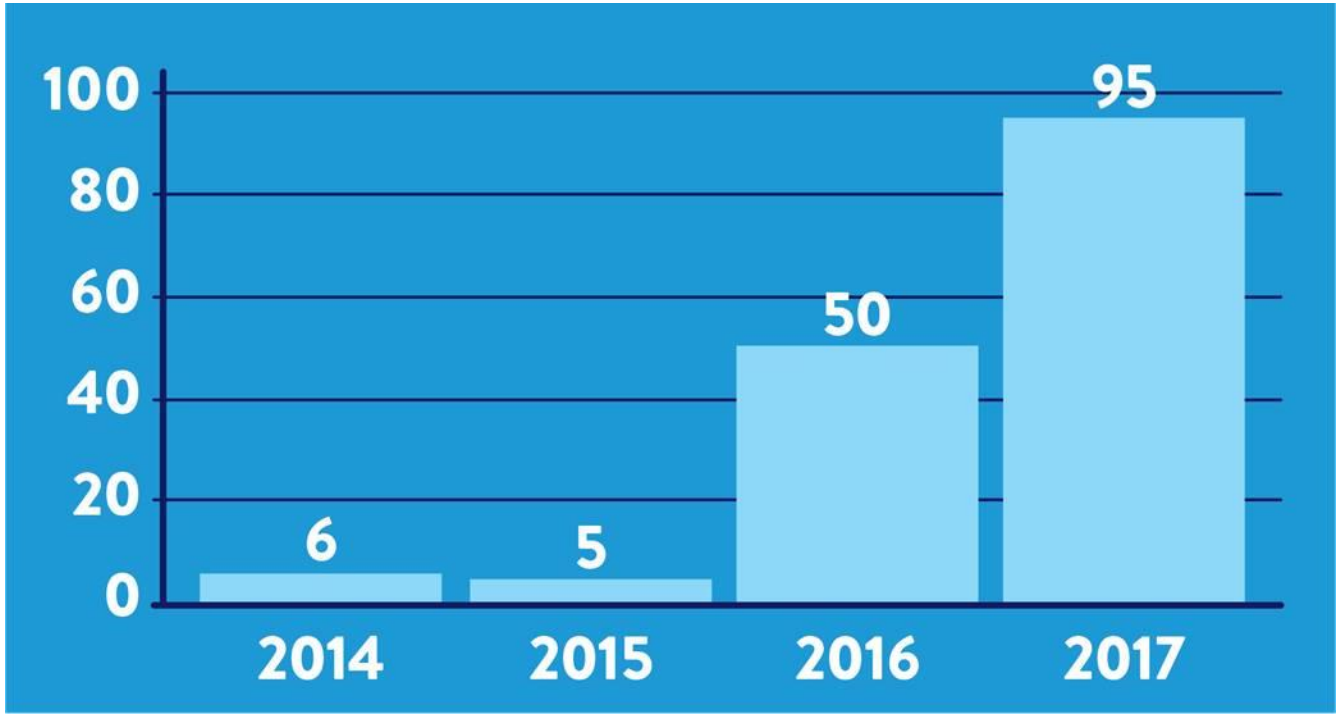
INCREASE IN ADVERSE (MAUDE) EVENTS RELATED TO BIOTIN INTERFERENCE REPORTED TO FDA



Data from US FDA Manufacturer and User Facility Device Experience database. The MAUDE database houses medical device reports submitted to the FDA by mandatory reporters (manufacturers, importers and device user facilities) and voluntary reporters such as health care professionals, patients and consumers
https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfmaude/search.cfm

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MAUDE Adverse Event Report due to Biotin Interference

ROCHE DIAGNOSTICS TROPONIN T HIGH SENSITIVITY IMMUNOASSAY METHOD, TROPONIN SUBUNIT

Device Problem: Low Test Result

Event Date: 09/08/2016

Event Type: Death

Description:

- Patient with M.S. was admitted to the ER with chest pain. The patient's troponin was tested with the Elecsys hsTroponin T assay and on the Cobas 8000 e602 module and the result was <5ng/L.
- Patient was admitted to ICU for an unknown reason. Troponin testing was tested 5 days later and found to be 55ng/L.
- Additional information has been requested but not yet provided.

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30. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfmaude/detail.cfm?mdrfoi__id=6263188&pc=MMI

FDA Safety Communication

The FDA Warns that Biotin May Interfere with Lab Tests: FDA Safety Communication

Date Issued: November 28, 2017

Audiences:

- People taking or considering taking biotin, vitamin B7, supplements
- Physicians and other health care providers who order lab tests
- Lab personnel
- Lab test developers

Specialties:

All physicians and health care providers

Product:

Many lab tests use biotin technology due to its ability to bond with specific proteins which can be measured to detect certain health conditions. For example, biotin is used in hormone tests and tests for markers of cardiac health like troponin. Biotin, also known as vitamin B7, is a water-soluble vitamin often found in multi-vitamins, prenatal vitamins, and dietary supplements marketed for hair, skin, and nail growth.

Purpose:

The FDA is alerting the public, health care providers, lab personnel, and lab test developers that biotin can significantly interfere with certain lab tests and cause incorrect test results which may go undetected.

Summary of Problem and Scope:

Biotin in blood or other samples taken from patients who are ingesting high levels of biotin in dietary supplements can cause clinically significant incorrect lab test results. The FDA has seen an increase in the number of reported adverse events, including one death, related to biotin interference with lab tests.

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31. https://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm586505.htm

FDA Safety Communication

The FDA Warns that Biotin May Interfere with Lab Tests: FDA Safety Communication

Date Issued: November 28, 2017

For lab personnel:

- If you use assays with biotin technology, be aware that it is difficult to identify samples that contain biotin; therefore, it is important to communicate with health care providers and patients to prevent incorrect test results.
- If you are collecting samples in the lab, ask whether the patient is taking biotin.
- Educate health care providers about biotin interference with certain lab tests used in your lab.
- Consider that the daily recommended allowance for biotin is 0.03 mg and these biotin levels do not typically cause significant interference. However, supplements containing high biotin levels including those marketed for hair, skin, and nail benefits, may contain up to 20 mg of biotin, and physicians may recommend up to 300 mg per day for conditions such as multiple sclerosis. Biotin levels higher than the recommended daily allowance may cause significant interference with affected lab tests.
- Be aware that specimens collected from patients taking high levels of biotin may contain more than 100 ng/mL biotin. Concentrations of biotin up to 1200 ng/mL may be present in specimens collected from patients taking up to 300 mg per day.
- Currently available data is insufficient to support recommendations for safe testing using affected tests in patients taking high levels of biotin, including about the length of time for biotin clearance from the blood.
- Communicate with the lab test manufacturer if you have questions about biotin interference.

31. https://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm586505.htm

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Impact of Interferences

- Interfering substances can affect lab test results
  - **Examples: Heterophilic antibodies, HAMA**
- Interference could depress or elevate a test result, causing false-negative or false positive result
- Most of these interferences are rare and could affect any platform
- Test manufacturers usually add blocking agents to the test minimize these interferences

Incorrect lab results from interferences could lead to misdiagnosis of a patient

Although heterophile antibodies are found in all people, interference occurs rarely, < 0.05% of the time

INTERFERENCE CHARACTERISTICS	HETEROPHILIC Ab INTERFERENCES	BIOTIN INTERFERENCE
Interference can lead to incorrect test results	**Yes**	**Yes**
Prevalence is rare	**Yes**	**No**
Interference is innate and unique to an individual	**Yes**	**No**
Mostly mitigated by test manufacturers by adding blocking agents	**Yes**	**No**
Interfering substance is not a critical component of the impacted test	**Yes**	**No**
Interference is not specific to a particular capture method	**Yes**	**No**

Source: Levinson SS et al. Clinica Chimica Acta, 2002; 3251 –15

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Biotin Usage and Awareness

Of patients surveyed,

17% report taking biotin*

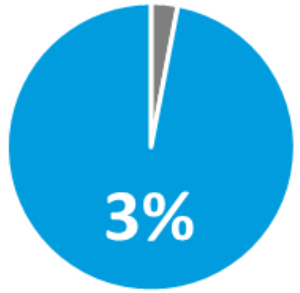
Biotin is more likely to be used by females in the US

♂ **26%** Male

♀ **74%** Female

BIOTIN AWARENESS
What do patients know?

Although generally a health conscious group, only a **small fraction** of patients surveyed who take biotin know about the potential risks.



of **patients** are aware of issues with lab testing and biotin

*Biotin consumption taken from 2017 quantitative study among 400 US patients between the ages of 30-69 who have used either inpatient or outpatient hospital services and have had a blood test.

Source: Data on File at Abbott

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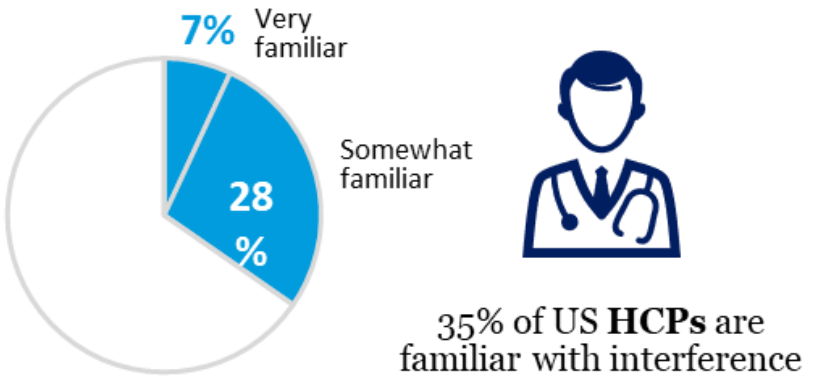
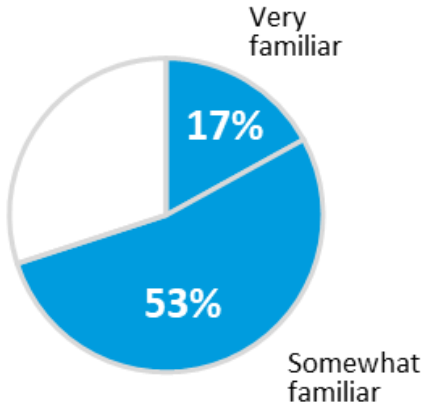
Biotin Awareness



35% of US **HCPs** are familiar with interference effects of biotin on lab tests



70% of US **lab directors** are familiar with interference effects of biotin on lab tests

More than **1/2** of HCPs and nearly **2/3** of lab directors are **very concerned** about undetected interferents in lab tests

Source: Data on File at Abbott

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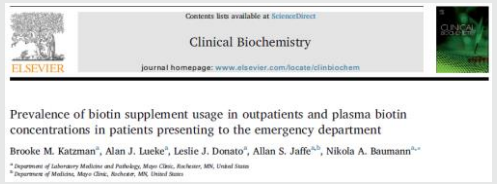
Publication from Mayo Clinic on Biotin Usage



Contents lists available at ScienceDirect

Clinical Biochemistry

journal homepage: www.elsevier.com/locate/clinbiochem

Prevalence of biotin supplement usage in outpatients and plasma biotin concentrations in patients presenting to the emergency department

Brooke M. Katzman[a], Alan J. Lueke[b], Leslie J. Donato[a], Allan S. Jaffe[a,b], Nikola A. Baumann[b,*]

[a] Department of Laboratory Medicine and Pathology, Mayo Clinic, Rochester, MN, United States
[b] Department of Medicine, Mayo Clinic, Rochester, MN, United States

Objective:

To determine the prevalence of biotin consumption using two distinct methods:

- Surveying the outpatient population using a questionnaire
- Quantifying biotin in samples collected from patients presenting to the ED

Results:

- Survey of 1944 outpatients indicated that 7.7% take biotin
- Quantitation of biotin in 1442 ED patient samples revealed that 7.4% had biotin concentrations at or above 10 ng/ml which is the lowest known threshold for biotin interference in the tests utilized at Mayo Clinic

Conclusion:

- Reported use of biotin was common
- Biotin concentrations in ED patient samples highlights the magnitude of the biotin interference problem and identifies a population at risk for potential harm
- These findings should guide laboratorians and clinicians in developing effective strategies to mitigate safety risks and in assessing biotin usage trends within their own patient populations

Source: Katzman BM et al, Clinical BioChemistry, 2018; 60: 11-16

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Data on File at Abbott

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Impact of Diagnostic Errors: Case 1

- 6 children (ages 1 month - 9 years) receiving high-dose biotin treatment for inherited metabolic diseases
- During routine examination, lab results suggestive of Graves' disease found in all 6 patients:
  - Free T4 ↑
  - Total T3 ↑
  - Anti-Thyrotropin Receptor Ab's ↑
  - TSH ↓
- Lab results led to initiation of anti-thyroid treatment in these children
- Ultra-sonographic scans of the thyroid were normal
- Literature search identified biotin issues, and biotin treatment immediately discontinued
- Free T4, Total T3, and TSH normalized 1-2 days after biotin discontinuation, but anti-thyrotropin receptor Ab's took up to 1 week to normalize

Source: Kummer S et al. New England Journal of Medicine 2016; 375 (7): 704-706

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What went wrong?

- Biotin interference gave incorrect lab results
  - Some markers falsely ↑
  - Some markers falsely ↓
- Combination of incorrect results mimics disease pattern that clinicians recognize, results in incorrect diagnosis of Graves' disease
- Children unnecessarily treated with anti-thyroid medication, and ultra-sonographic thyroid scans conducted
  - Patient Safety ↓
  - Testing Costs ↑
- Even after biotin discontinuation, some results didn't normalize until 1 week later
- Biotin interference can't be prevented by simply skipping normal biotin dose a few hours before blood draw

Source: Kummer S et al. New England Journal of Medicine 2016; 375 (7): 704-706

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Impact of Diagnostic Errors: Case 2

- 48-year-old woman presented with palpitations, male-pattern hair growth and inability to lose weight
- Lab tests revealed unusual endocrine hormonal profile
  - Pituitary hormones **below** reference intervals
  - Testosterone and cortisol hormones **above** reference intervals
- A potential testosterone-secreting tumor was suspected as the source for the high testosterone
- Surgery to remove uterus and ovary was recommended and scheduled

Source: Stieglitz HM et al, Journal of the Endocrine Society, 2018; 2 (6): 563–569

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What went wrong?

Patient was taking biotin (5 mg/day) regularly for 6 months and intermittently for 5 years, which interfered with the lab tests used and caused an aberrant hormone profile

1	24-hour radioactive Iodine uptake and Scan
2	Anti-thyroid Therapy
3	Pituitary MRI to rule out a nonfunctioning adenoma
4	CT scan to rule out adrenal pathology
5	Referral to reproductive endocrinologist
6	Pelvic ultrasound
7	Surgery to remove uterus and ovaries recommended & scheduled
8	Repeated testing on various other platforms

Ripple Effect:
One diagnostic error had a huge patient impact

Increased Cost, Waste of Resources and Impact on Patient Safety

Source: Stieglitz HM et al, Journal of the Endocrine Society, 2018; 2 (6): 563–569

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Mechanism of Biotin Interference in Immunoassays

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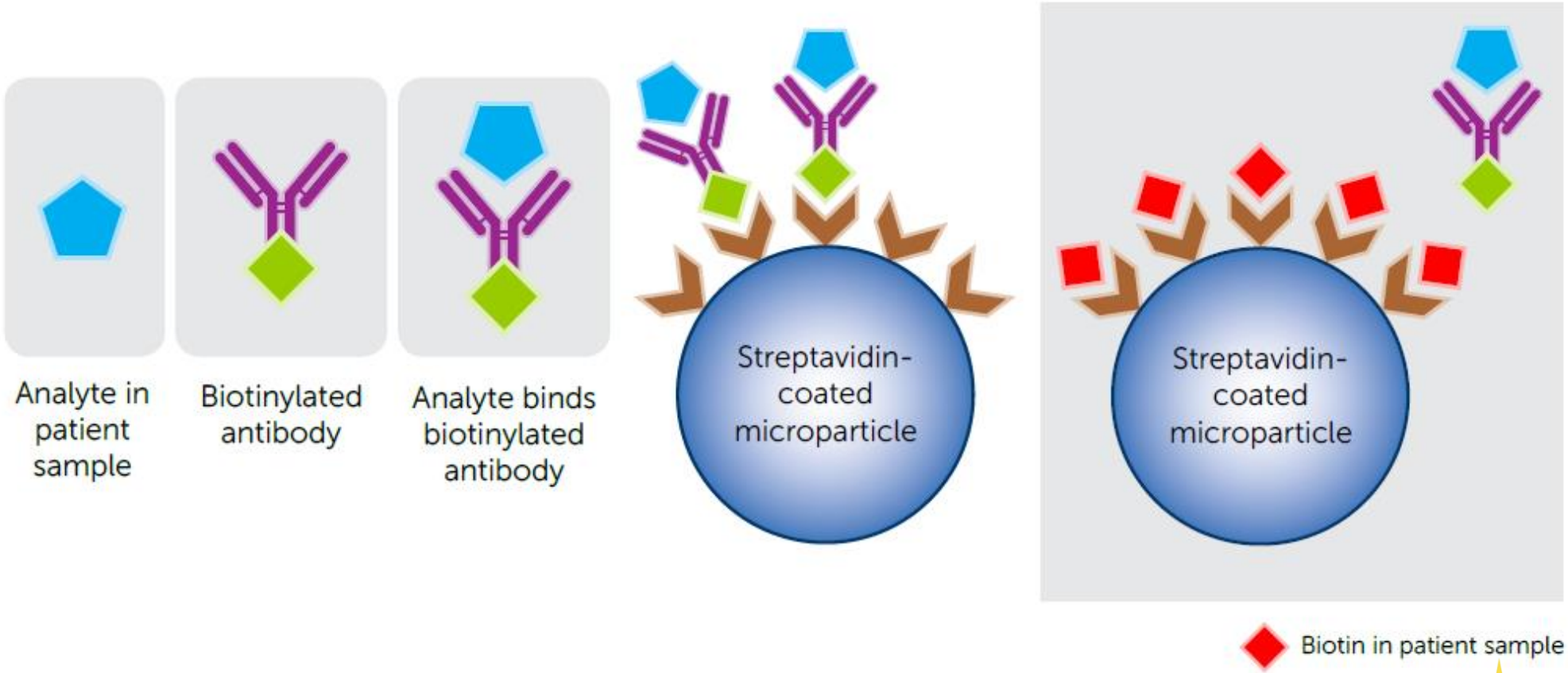
Biotin Interference with Biotin-Streptavidin Format



27. http://www.clpmag.com/2018/01/inside-track-biotin-gets-safety-alert/

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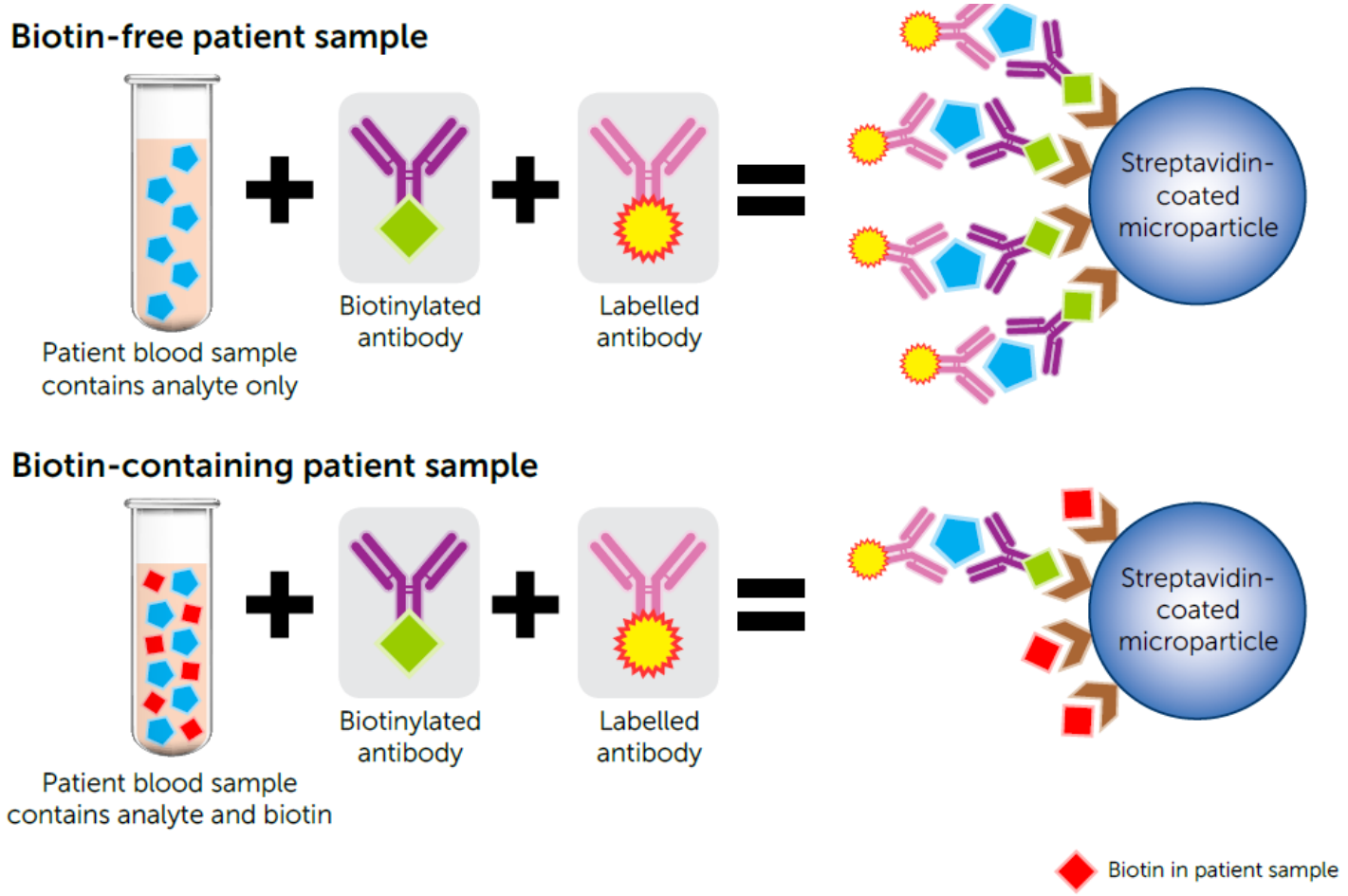
Sandwich Format may result in Falsely Low Results



27. http://www.clpmag.com/2018/01/inside-track-biotin-gets-safety-alert/

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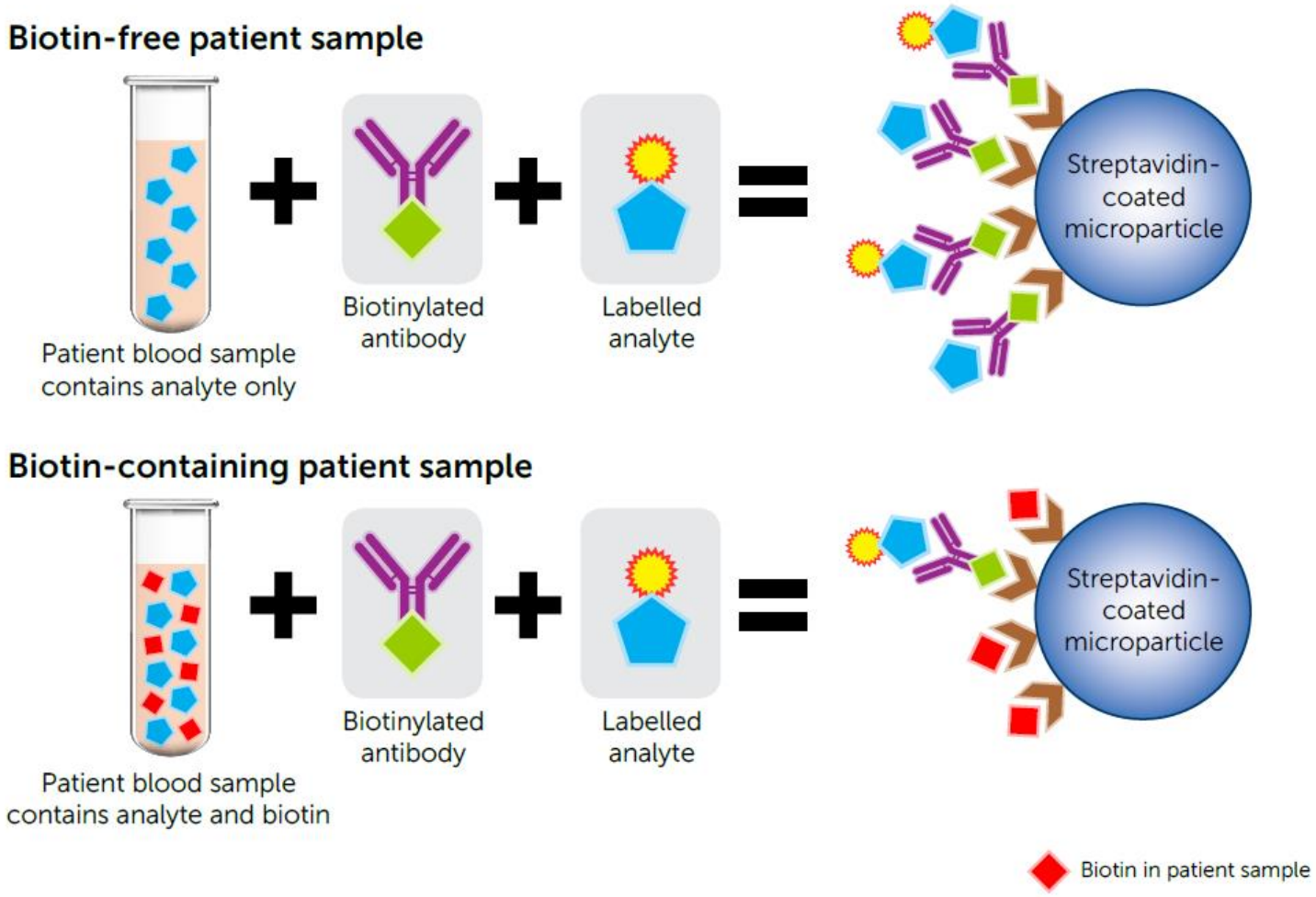
Competitive Format may result in Falsely Elevated Results



27. http://www.clpmag.com/2018/01/inside-track-biotin-gets-safety-alert/

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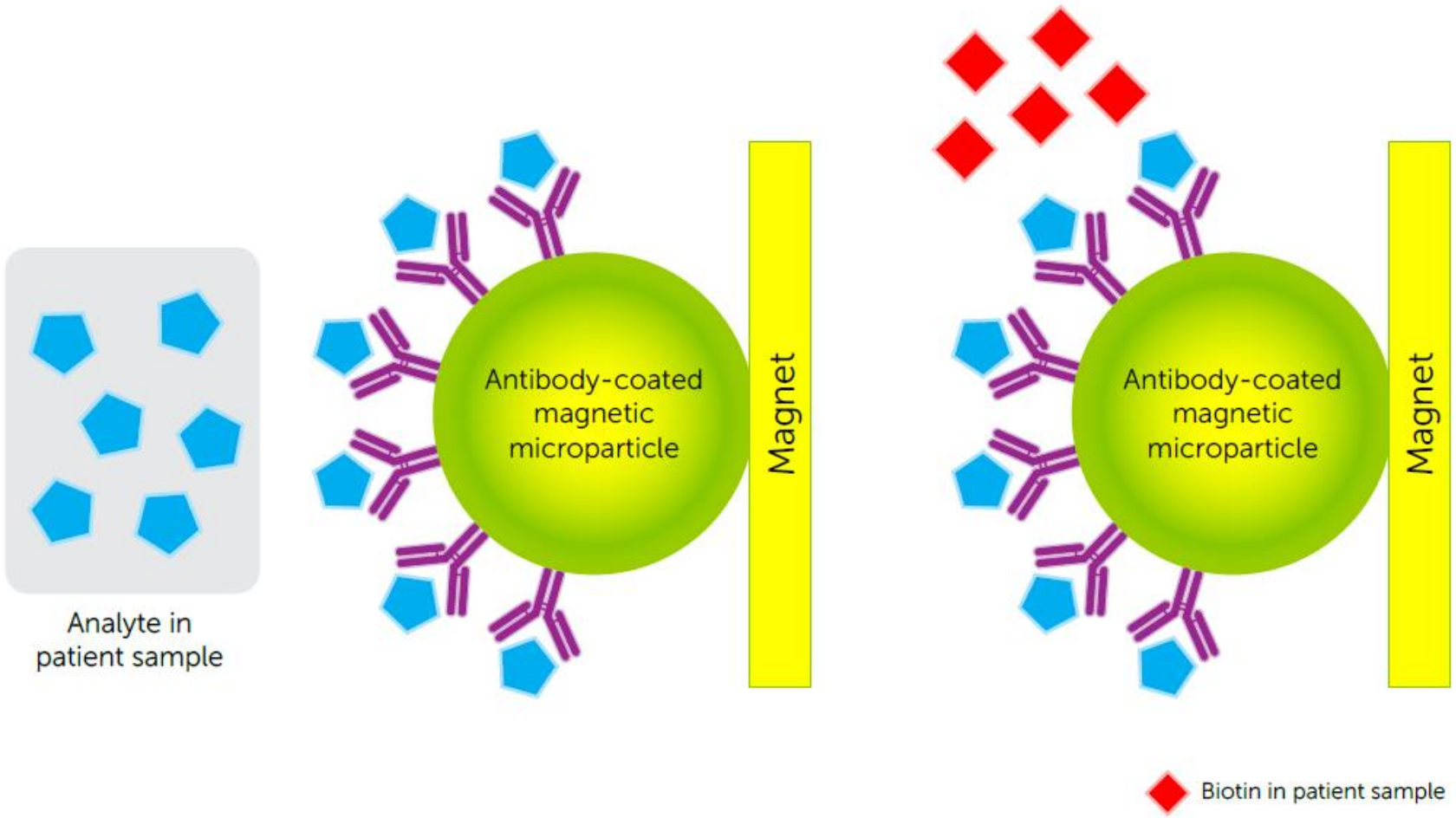
No Biotin Interference with Magnetic Separation Technique



27. ttp://www.clpmag.com/2018/01/inside-track-biotin-gets-safety-alert/

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“Extreme laboratory test values as well as clinically discordant ones may be easily recognized as interferences, but subtle or moderate biotin-induced changes in results would not be identifiable by the laboratory. Even a slight skewing of results can pose serious ramifications for tests in which misdiagnosis of serious infectious diseases such as HIV or hepatitis C virus or failure to recognize a tumor recurrence may occur. Emergency room patients may be at risk if biotin interferes with the assays for cardiac markers. Patients on thyroid medication may be titrated improperly owing to inaccurate but clinically congruous laboratory results. And the list goes on, and clinicians who recognize these problems will be looking to laboratorians for guidance.”

Biotin Interference in Diagnostic Tests
Kelly Y. Chun
DOI: 10.1373/clinchem.2016.267286 Published January 2017

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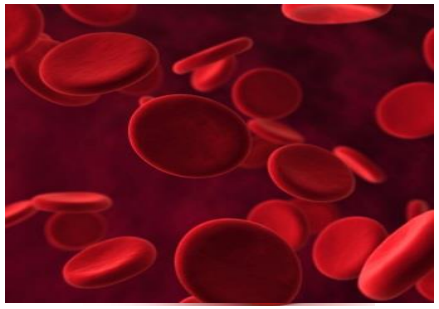
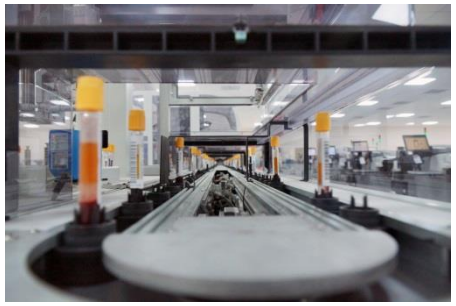
How Biotin Interference Can Impact Patient Care

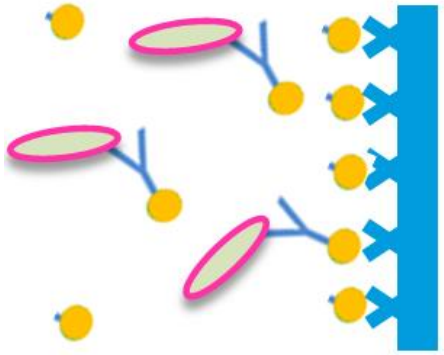


Patients take biotin supplements. Unbound biotin flows in their blood

Physicians draw blood from the patient to perform lab tests



The blood sample is sent to a lab to have lab tests performed



Unbound biotin in the blood sample attaches to the binding site, preventing the targeted antigen to be bound, resulting in erroneous results being reported.

Physicians utilize the inaccurate result to misdiagnose and mistreat patients.

Biotin interference can lead to inaccurate test results that could potentially lead to the misdiagnosis and mistreatment of patients

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Biotin Streptavidin Used in Assay Design

Table 1
Biotin Interference in Tests Performed by 7 Automated Clinical Assay Systems[a]

Multitest assay system	All immunoassays			Endocrine immunoassays		
	Total	Vulnerable to biotin interference	Biotin interference threshold (range, nmol/L)	Total	Vulnerable to biotin interference	Interference thresholds of potentially vulnerable endocrine tests (test [threshold in nmol/L], direction of IF)[b]
Roche Elecsys®	81	81	21-491	46	46	http://www.roche-diagnostics.ch/content/dam/corporate/roche-dia_ch/documents/serumindices/Interferences_Immunologie.pdf[30]
Ortho Vitros®	43	29	10-82	17	11	TSH[21]↓, iPTH[20]↓, FSH[41]↓, LH[21]↓, hCG[40]↓, PRL[41]↓, E2[21]↑, PRG[82]↑, TSTN[41]↑, CORT[40]↑, 25OHD[62]↑
Siemens Dimension®	26	21	205-8,200 (3 n/a)	10	9	TSH[2,050]↓, FT4[205]↑, FT3[205]↑, FSH[409]↓, LH[409]↓, hCG[n/a], PRL[8,200]↓, PROG[406]↑, TSTN[406]↑
Siemens Centaur®	67	18	41-4,090 (6 n/a)	20	4	FT4[n/a], iPTH[4,090]↔, DHEAS[409]↑, SHBG[409]↓
Beckman Coulter Access®/DXI®	48	14	41-1,000 (9 n/a)	26	6	FT4[n/a], FT3[41]↑, TT3[n/a], TG[n/a], TGAb[n/a], TPOAb[n/a]
Abbott Architect i2000®	46	2	120 (1 n/a)	18	2	TSTN[120]↔, 25OHD[n/a]
Diasorin Liaison XL®	42	0	------	20	0	------

28. Samarasinghe S et al. Endo Practice 2017; 23 (8): 989-998.

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Biotin-Based Assays at High Risk for Interference

Biotin-Based Immunoassays at High Risk for Analytic Interference by Biotin Supplements

Multitest Assay System	No. of Methods			Vulnerable Immunometric and Competitive Methods With IFTs of <51 ng/mL or no IFTs Reported in the Product Labeling
	Total	BBAs	High Risk[a]	Method(s) [IFT in ng/mL] or Method(s) [NR][b]
Elecsys[c]	66	66	44	Folate [**5**]; anti-HBsAg [**8**]; anti-TPO, anti-TSHR, and total T3 [**10**]; free T4, progesterone, and TnT [**20**]; TSH [**25**]; anti-CCP, anti-HBc, procalcitonon, CK-MB, cortisol, DHEAS, free PSA, GH, BNP, TSTN, thyroglobulin, and TnI [**30**]; CA 125 [**35**]; estradiol [**36**]; calcitonin, HBeAg, HBsAg, hCG, prolactin, and T uptake [**40**]; anti-HCV [**42**]; iPTH, anti-HAV, anti-HAV IgM, B12, Cyfra 21-1, ferritin, HE4, HSV-1 IgG, HSV-2 IgG, LH, myoglobin, osteocalcin, rubella IgG, and rubella IgM [**50**]
Vitros[d]	37	30	28	TnI [**2.4**]; estradiol, iPTH, LH, and TSH [**4.8**]; cortisol, hCG, AFP, anti-HAV, anti-HAV IgM, anti-HBe, CA 125, CA 15-3, CEA, CK-MB, ferritin, folate, FSH, HBeAg, prolactin, TSTN, and total PSA [**10**]; 25 OHD [**15**]; B12, myoglobin, BNP, and progesterone [**20**]; anti-HBc IgM [**NR**]
Access/DXI[e]	37	15	6	Free T3 [**10**]; CA 19-9, free T4, myoglobin, thyroglobulin, and total T3 [**NR**]
Centaur[f]	65	23	7	HBsAG and TnI [**10**]; folate [**13**]; HAV total [**25**]; TSTN and anti-HBc IgM [**30**]; anti-HAV IgM [**50**]
Immulite 2000[f]	60	60	6	IgE allergy, gastrin, CA 15-3, CRP, free T3, and thyroglobulin [**NR**]
Dimension[f]	26	23	6	Free T3, free T4, and digoxin [**50**]; hCG, myoglobin, and TnI [**NR**]
Architect i2000[g]	47	4	0	None
Liaison XL[h]	36	0	0	None

29. Holmes EW et al. Arch Pathol Lab Med; 2017, 141: 1459-1460.

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Biotin Streptavidin Used in Assay Design

Table 2: Examples of five widely used hormone immunoassays, using streptavidin-biotin interaction.

Hormone assays	Company (analyzer)				
	Beckman Coulter (Access, DXi, DxC)	Immuno diagnostic system (Isys)	Ortho Clinical Diagnostic (Vitros)	Roche (Cobas, Elecsys, Modular)	Siemens (Dimension Vista, Exl)
FT3	✔			✔ (286)	✔ (205)
FT4	✔			✔ (82)	✔ (205)
Total T3				✔ (41)	
Total T4				✔ (409)	
TSH			✔ (20.5)	✔ (102)	✔ (2050)
TRAb				✔ (41)	
SHBG	✔			✔ (246)	
Thyroglobulin	✔			✔ (327)	
PTH		✔	✔ (20.5)	✔ (205)	
25OH vit D		✔ (300)	✔ (61)	✔ (286)	
Cortisol			✔ (41)	✔ (123)	
ACTH				✔ (246)	
Testosterone			✔ (41)	✔ (123)	
Estradiol			✔ (20.5)	✔ (147)	✔
FSH			✔ (41)	✔ (246)	✔
LH			✔ (20.5)	✔ (205)	✔
Prolactin			✔ (41)	✔ (164)	✔
IGF1		✔ (300)			
GH		✔ (300)		✔ (123)	
C peptide				✔ (246)	
Insulin				✔ (246)	

21. Piketty ML et al. Clin Chem Lab Med. 2016 Oct 12.

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Pharmacokinetics of Biotin

- The time needed to recover biotin plasma concentrations compatible with the diagnostic tests using biotin-streptavidin is not known with precision across all platforms and assays. [7]
- It may be as long as a few weeks according to simulated data and published data on withdrawal of high-dose biotin therapy [7, 27]
- Some immunoassays can show interference even with a biotin plasma concentration as low as **10 ng/mL**[7]
- The mean maximum plasma was **~1000 ng/mL** in a high-dose biotin clinical trial[7]
- In general, biotin is rapidly cleared, with patients taking 5mg/day they generally fall below interference thresholds (<30 ng/mL) within 4-8 hours.

7. Peyro Saint Paul L et al. Expert Opinion on Drug Metabolism & Toxicology, 2016; 12:(3), 327-344.
23. Mardach R, Zempleni J, Wolf B, et al; J Clin Invest. 2002;109 (12):1617–1623.

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Pharmacokinetics of Biotin

For Patients on Hemodialysis:

More than 70% of the patients had mean values higher than 1000 ng/liter, the highest values found in the general population. The patients on HD for more than five years had significantly higher levels than those having been dialyzed for shorter periods (1642 873 vs. 1274 740 ng/liter, $P < 0.01$) and anuric patients had significantly higher values than those with residual diuresis.

Water Soluble Vitamins in Chronic Hemodialysis Patients and Need for Supplementation, Eris Descombes, Alfred B. Hanck, and Gilbert Fellay. Kidney International, Vol. 43 (1993), PP. 1319—1328
Dialysis Unit, Department of Medicine, Hôpital Cantonal, Fribourg, and Vitamin Research Laboratories, Hoffmann-La-Roche, Basel, Switzerland

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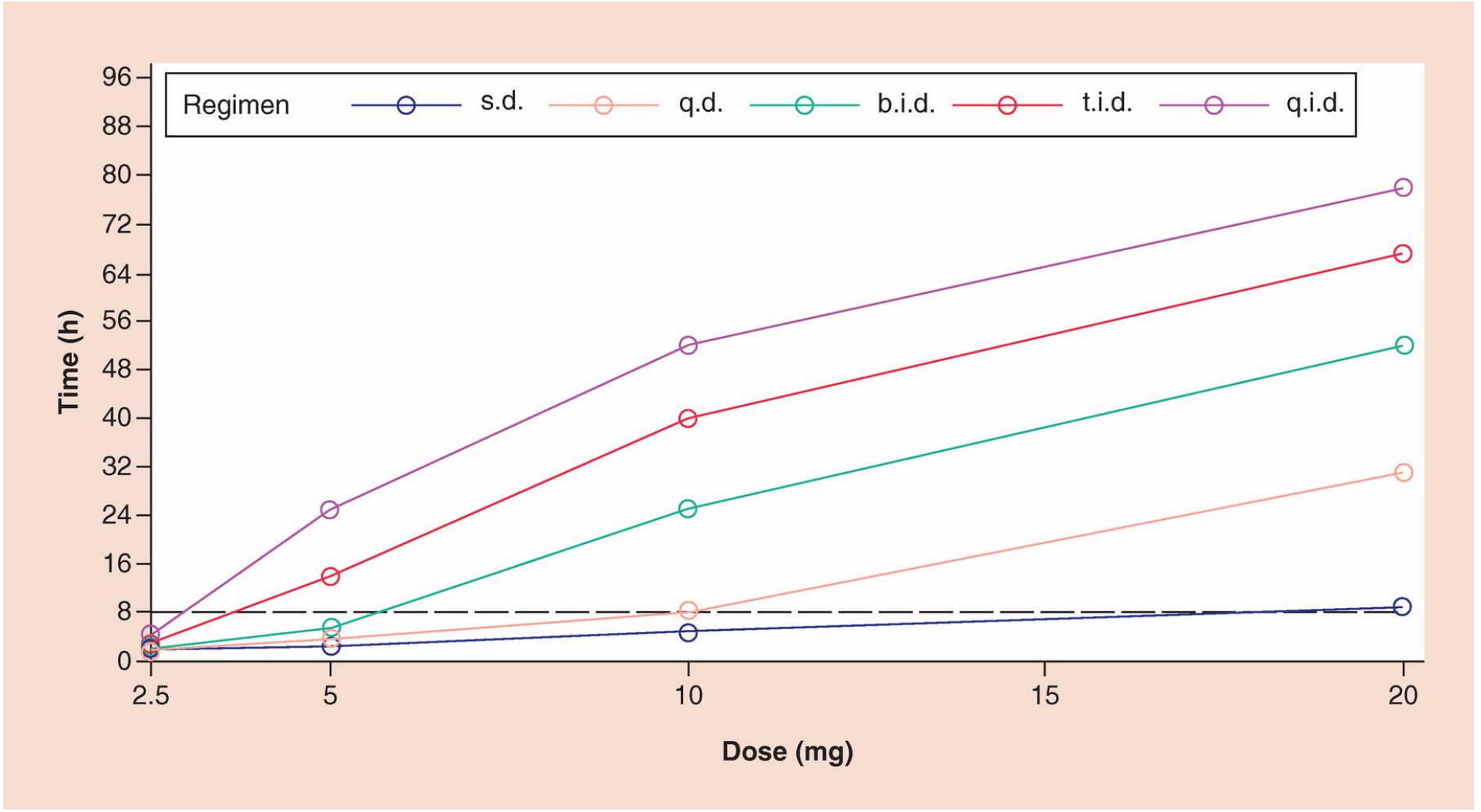

Simulation of time required for biotin serum concentration to fall below 30 ng/ml following biotin intake in the 54 participants characterized in the pharmacokinetic study.

b.i.d.: Twice a day; q.d.: Once daily; q.i.d.: Four-times a day; s.d.: Single dose; t.i.d.: Three-times a day.

Population pharmacokinetics of exogenous biotin and the relationship between biotin serum levels and in vitro immunoassay interference
Paul Grimsey, Nicolas Frey, Garnet Bendig, Juergen Zitzler, Oliver Lorenz, Dusanka Kasapic & Christian E Zaugg
International Journal of PharmacokineticsVolume 2, Issue 414 Sep 2017

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ADD-00066054

Wash Out Period for Biotin

THYROID
Volume 26, Number 10, 2016

DOI: 10.1089/thy.2016.0229

SPECIAL ARTICLE

2016 American Thyroid Association Guidelines for Diagnosis and Management of Hyperthyroidism and Other Causes of Thyrotoxicosis

Douglas S. Ross,[1*] Henry B. Burch,[2**] David S. Cooper,[3] M. Carol Greenlee,[4] Peter Laurberg,[5†] Ana Luiza Maia,[6] Scott A. Rivkees,[7] Mary Samuels,[8] Julie Ann Sosa,[9] Marius N. Stan,[10] and Martin A. Walter[11]

Ingestion of high doses of biotin may cause spurious results in assays that utilize a streptavidin–biotin separation technique (41,42). In immunometric assays, frequently used to measure TSH, excess biotin displaces biotinylated antibodies and causes spuriously low results, while in competitive binding assays, frequently used to measure free T_4, excess biotin competes with biotinylated analogue and results in falsely high results. Patients taking high doses of biotin or supplements containing biotin, who have elevated T_4 and suppressed TSH, should stop taking biotin and have repeat measurements at least 2 days later.

24. Ross et al. American Thyroid Association Guidelines; 2016; Thyroid;26(10): 1343-1421

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Wash Out Period for Biotin

Table 1. Biotin Interference with Streptavidin–Biotin Immunoassays Leading to Falsely High Results in Competitive Formats and Falsely Low Results in Sandwich Formats.*

Test	Biotin-Affected Assay		Non–Biotin-Affected Assay	
	Result	Normal Reference Interval, Adults	Result	Normal Reference Interval, Adults
Competitive immunoassays				
Free thyroxine (pmol/liter)	>100.0†	12.0–22.0	11.3	9.0–19.0
Free triiodothyronine(pmol/liter)	17.3†	3.2–6.4	4.5	2.6 –6.0
Testosterone (nmol/liter)	42.9†	9.9–27.8	10.1	9.5–28.0
Estradiol (pmol/liter)	740†	<160	73	<160
Progesterone (nmol/liter)	125.4†	<4.3	0.4	<4.1
DHEA sulfate (μmol/liter)	>27.1†	1.2–9.0	6.6	3.0–16.0
Vitamin B_{12} (pmol/liter)	>1400†	200–700	380	135–650
Sandwich immunoassays				
Thyrotropin (mU/liter)	0.02‡	0.50–5.50	1.30	0.40–4.00
Prostate-specific antigen (ug/liter)	0.04‡	0.25–3.00	0.60	0.25–3.00
Parathyroid hormone (pmol/liter)	0.6‡	1.6–6.9	2.8	1.6–6.9
Luteinizing hormone (IU/liter)	0.2‡	1.7–8.6	1.4	1.1–8.8
Follicle-stimulating hormone (IU/liter)	0.4‡	1.5–12.4	8.5	1.0–12.0

interference. In patients who are receiving high-dose biotin, this agent should be withheld for 72 hours before blood tests in order to minimize interference.

20. Trambas C. M. et al. New England Journal of Medicine 2016; 375 (17): 1698

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Wash Out Period for Biotin

Biotin Treatment Mimicking Graves' Disease

Table 1. Characteristics of Six Children with Biotin-Induced Laboratory Indications of Autoimmune Hyperthyroidism.*

Variable	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6
Sex	Female	Female	Male	Male	Male	Male
Age	9 yr	2 yr	2 yr	5 mo	1 mo	1 mo
Primary disease	BTBGD	BTBGD	BTBGD	Infantile mitochondrial disease	Neonatal mitochondrial disease	Neonatal mitochondrial disease
Biotin dose (mg/kg/day)	10	14	15	2	7	8
Concomitant medication	Thiamine	Thiamine, methimazole, cholecalciferol, levetiracetam, chloral hydrate	Thiamine, methimazole, oxcarbazepine	Thiamine, sodium phenylbutyrate, propranolol, nystatin, cholecalciferol	CoQ10, thiamine, cholecalciferol, carnitine, riboflavin, bisoprolol, aspirin, furosemide	CoQ10, thiamine, methimazole, cholecalciferol, carnitine, riboflavin
Laboratory results						
During biotin treatment						
Thyrotropin (μIU/ml)	0.05	0.02	0.04	0.02	0.08	0.03
Free T_4 (ng/dl)	6.24	>7.77	>7.77	>7.77	>7.77	>7.77
Anti–thyrotropin receptor antibodies (IU/liter)	38.6	>40.0	>40.0	>40.0	>40.0	>40.0
Total T_3 (ng/dl)	>6.5	ND	>6.5	>6.5	>6.5	ND
1–7 Days after discontinuation of biotin						
Thyrotropin (μIU/ml)	1.80	3.75	6.07	2.20	8.12	2.87
Free T_4 (ng/dl)	1.58	1.70	1.16	1.13	1.84	1.91
Anti–thyrotropin receptor antibodies (IU/liter)	<0.3	ND	0.7	1.0	0.4	<0.3
Total T_3 (ng/dl)	2.0	ND	1.8	ND	1.8	2.3
Antithyroid medication	No	Methimazole treatment for 14 mo with up to 1.9 mg/kg/day†	Methimazole treatment for 3.5 mo with up to 0.9 mg/kg/day‡	No	No	Methimazole treatment for 2 wk

In our patients, thyrotropin and thyroid hormone levels were normalized 24 to 48 hours after the discontinuation of biotin, whereas levels of anti–thyrotropin receptor antibodies took up to 7 days to normalize.

25. Kummer S et al. New England Journal of Medicine 2016; 375 (7): 704-706

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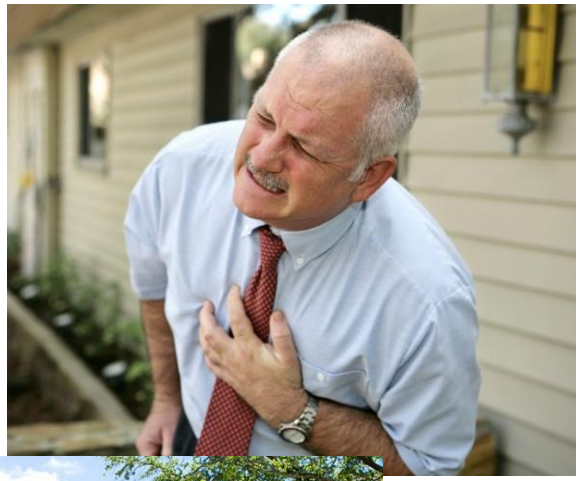
Biotin Interference in Acute Setting (ED and ICU)

- Patient may not be aware that their supplements contain biotin
- Physician in the ED or ICU may not know that the patient is taking biotin
- Waiting for 24 to 48 hours for biotin to clear prior to testing for troponin or procalcitonin may not be an option in an acute setting



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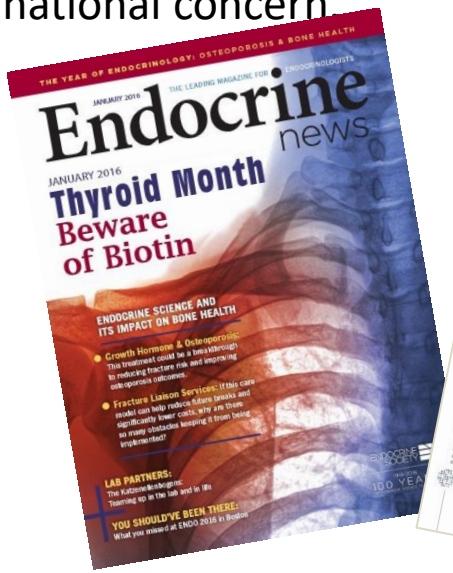
Our Experience With Biotin at Our Clinic

- In 2016, after having the Abbott ARCHITECT for several months, I was alerted to the concept of Biotin Interference from my Abbott customer support representative and was pointed to several articles including the January 2016 article in Endocrine News, "**Thyroid Month: Beware of Biotin**" as well as the September 2016 CAP Today article, "**Beauty Fad's Ugly Downside: Test Interference**."
- On November 28, 2017 the FDA released a safety communication, "**The FDA Warns that Biotin May Interfere with Lab Tests: FDA Safety Communication**".
- In the following months many news outlets picked up the story and the issue quickly became an issue of national concern.



10. Paxton A. CAP Today, September 20, 2016.
11. Seaborg, E. January 2016: Thyroid Month: Beware of Biotin, Endocrine News, 2016.
31. https://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm586505.htm
33. http://abc7chicago.com/health/beauty-vitamin-biotin-may-affect-medical-test-results-/3194538/?sf184122004=1

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Our Response to the FDA Safety Communication

- We issued an alert to Medical Staff that they can be assured we have no issues with biotin interference in our lab using the Abbott ARCHITECT.
- But the Reference Lab we send-out our patient samples to is affected by Biotin Interference.
- So we should be careful to chart any use of biotin containing supplements into the patients chart, so they may prepare for any send-out lab tests appropriately.
- We started asking the patients if they were taking biotin and how much during check-in to the lab in addition to the usual fasting status question.
- An informational notice was posted at the lab check-in window.
- All send out immunoassay tests were investigated for biotin interference and an Ask At Order (AOE) question was built into each profile asking the patient if they had abstained from biotin for the suggested time interval.

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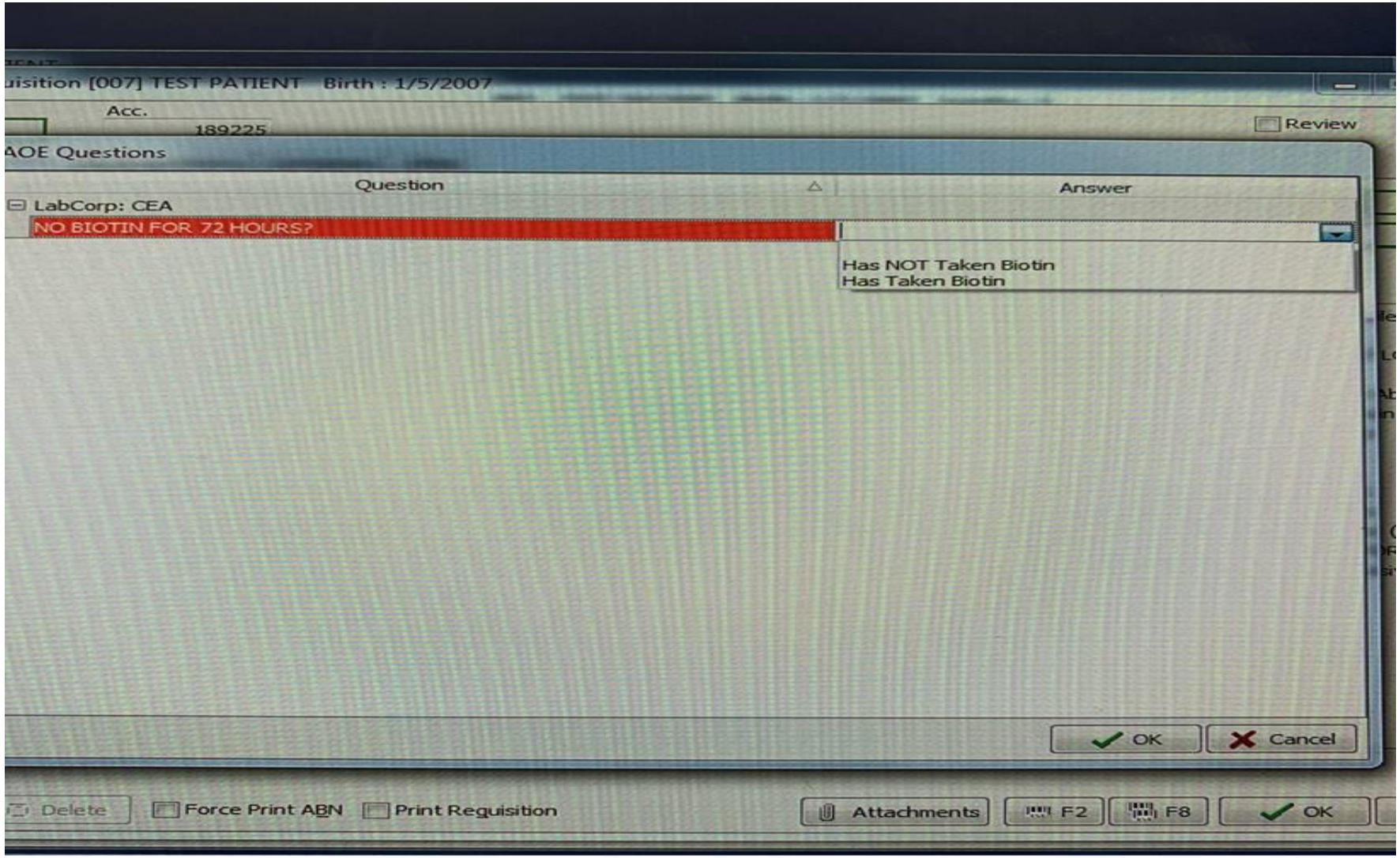

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The Challenges We Face

- **Using a survey tool for several days, I came to the conclusion that documentation of biotin use was going to be more difficult than anticipated.**

- When asked if they are taking Biotin or biotin containing supplements, B complex, multivitamins etc., many patients were bewildered about what we were asking them and some were offended that we asked (in relation to hair loss and skin issues). In our non-English speaking patients, elderly or cognitively challenged patients this question was met with the inability to answer effectively.
- It was very difficult to attain 100% compliance with staff to answer the question effectively in a busy clinic. It added another, more complicated question to a list of questions asked at check-in. Collecting this information was much more complicated and involved than a simple fasting or no fasting question.
- Documentation in the medical record by nurses was scanty or absent even though the patient was taking high dose biotin (5-10 mg or higher) as discovered at lab check-in. It was not considered a chartable medication or an important issue even though I had discussed with them the reasons why it should be done.
- It was difficult for staff to understand which tests may be affected.
- Many people, if not most, were taking multiple forms of Biotin. So it was difficult to ascertain the dosage level.

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Strategies to Mitigate Biotin Interference

- Increase clinician and patient awareness of biotin's effects on tests. Ensure proper patient preparation before specimen collection.
  - Will never completely eliminate the risk, there will always be misunderstandings, miscommunication and failures to comply.
- Biotin removal using immobilized streptavidin or paramagnetic beads
  - Expensive, slow and not practical for routine use
  - Need to perform extensive re-validation of all assays
- Selection of assays and equipment that is not prone to interference.
  - 100% method to eliminate the risk.
  - However, there will always be some assays that are only available in the biotin/streptavidin format.

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Conclusions : The Reality

- Use of Biotin may continue to be a major interfering factor in certain immunoassays on some platforms.
- The risk of incorrect lab test results may still be present despite the warnings and additional mitigations in place.
- Misdiagnosis and incorrect treatment decisions could result from incorrect lab test results.
- Not all assays and not all platforms are vulnerable to biotin interference.
  - Therefore, laboratories should be aware of the available options and perhaps considering selecting assays/instrumentation that are unaffected.
  - For the few tests only available with biotin/streptavidin format, ensure compliance with proper patient preparation.

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Thank you !!!

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