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BIOTIN INTERFERENCE IN THYROID FUNCTION AND CARDIAC TROPONIN ASSAYS

INTERFERÊNCIA DE BIOTINA NOS ENSAIOS DE FUNÇÃO TIREOIDIANA E TROPONINA CARDÍACA

INTERFERENCIA DE BIOTINA EN LOS ENSAYOS DE FUNCIÓN TIROIDEA Y TROPONINA CARDÍACA

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ABSTRACT

Biotin is present in common over-the-counter supplements and is also used at pharmacologic doses, but circulating biotin can interfere with immunoassays that depend on streptavidin–biotin capture. The direction and magnitude of error are determined by assay architecture, analyte, reagent generation, circulating concentration, and time from ingestion to sampling. This integrative review examined PubMed-indexed analytical studies, controlled ingestion studies, prevalence cohorts, case reports, and professional guidance addressing thyroid-related and cardiac troponin testing. In susceptible competitive thyroid assays, excess biotin commonly produces falsely increased results, whereas susceptible sandwich assays commonly produce falsely decreased results. The resulting combination of low thyroid-stimulating hormone and high free thyroid hormones can mimic hyperthyroidism and has caused diagnostic and therapeutic errors. Cardiac troponin is generally measured by sandwich immunoassay; interference can therefore lower the reported concentration and, in a time-critical setting, create false reassurance. Nevertheless, risk is not uniform across cardiac troponin T and I platforms, and newer reagent generations may tolerate substantially greater biotin concentrations. A reported dose alone cannot define safety because supplement formulation, timing, repeated exposure, renal clearance, and platform-specific thresholds differ. Recognition should begin with an explicit supplement history and assessment of clinical–laboratory discordance. Confirmation may require recollection after an appropriate interval, measurement on a method with different architecture, direct biotin measurement, or a locally validated depletion procedure. Universal washout rules and unvalidated numerical correction should be avoided. Effective prevention depends on coordinated communication among clinicians, laboratories, manufacturers, and patients, with special attention to thyroid panels and acute coronary syndrome pathways.

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Keywords: Biotin. Immunoassay Interference. Thyroid Function Tests. Cardiac Troponin. Laboratory Medicine. Patient Safety.

RESUMO
A biotina está presente em suplementos comuns disponíveis sem prescrição e também é usada em doses farmacológicas, mas a biotina circulante pode interferir em imunoensaios que dependem da captura streptavidina-biotina. A direção e a magnitude do erro são determinadas pela arquitetura do ensaio, analito, geração de reagentes, concentração circulante e tempo desde a ingestão até a coleta. Esta revisão integrativa examinou estudos analíticos indexados no PubMed, estudos de ingestão controlada, coortes de prevalência, relatos de casos e orientação profissional abordando testes relacionados a tireoide e troponina cardíaca. Em ensaios competitivos de tireoide suscetíveis, o excesso de biotina comumente produz resultados falsamente aumentados, enquanto ensaios sanduíche suscetíveis comumente produzem resultados falsamente diminuídos. A combinação resultante de hormônio estimulante da tireoide baixo e hormônios tireoidianos livres elevados pode mimetizar hipertireoidismo e causou erros diagnósticos e terapêuticos. A troponina cardíaca é geralmente medida por imunoensaio sanduíche; a interferência pode, portanto, reduzir a concentração relatada e, em um ambiente crítico quanto ao tempo, criar falsa tranquilidade. Não obstante, o risco não é uniforme entre as plataformas de troponina cardíaca T e I, e as gerações mais recentes de reagentes podem tolerar concentrações substancialmente maiores de biotina. Uma dose relatada isoladamente não pode definir segurança, pois a formulação do suplemento, tempo, exposição repetida, depuração renal e limites específicos da plataforma diferem. O reconhecimento deve começar com uma história de suplementos explícita e avaliação de discordância clínico-laboratorial. A confirmação pode exigir recol ação após um intervalo apropriado, medição em um método com arquitetura diferente, medição direta de biotina ou um procedimento de depleção validado localmente. Regras universais de eliminação e correções numéricas não validadas devem ser evitadas. A prevenção eficaz depende da comunicação coordenada entre clínicos, laboratórios, fabricantes e pacientes, com atenção especial aos painéis tireoidianos e aos caminhos da síndrome coronariana aguda.

Palavras-chave: Biotina. Interferência em Imunoensaio. Testes de Função Tireoidiana. Troponina Cardíaca. Medicina Laboratorial. Segurança do Paciente.

RESUMEN
La biotina está presente en suplementos comunes disponibles sin receta y también se utiliza a dosis farmacológicas, pero la biotina circulante puede interferir con inmunoensayos que dependen de la captura estreptavidina-biotina. La dirección y magnitud del error se determinan por la arquitectura del ensayo, analito, generación de reactivos, concentración circulante y tiempo desde la ingestión hasta la toma de muestras. Esta revisión integradora examinó estudios analíticos indexados en PubMed, estudios de ingestión controlada, cohortes de prevalencia, informes de casos y orientación profesional sobre pruebas relacionadas con la tiroides y troponina cardíaca. En ensayos competitivos de tiroides susceptibles, el exceso de biotina comúnmente produce resultados falsamente elevados, mientras que los ensayos tipo sándwich susceptibles comúnmente producen resultados falsamente disminuidos. La combinación resultante de hormona estimulante de la tiroides baja y hormonas tiroideas libres elevadas puede simular hipertiroidismo y ha causado errores diagnósticos y terapéuticos. La troponina cardíaca se mide generalmente por inmunoensayo tipo sándwich; la interferencia puede, por lo tanto, reducir la concentración informada y, en

un entorno crítico en el tiempo, crear falsa tranquilidad. Sin embargo, el riesgo no es uniforme en las plataformas de troponina cardíaca T e I, y las generaciones más nuevas de reactivos pueden tolerar concentraciones sustancialmente mayores de biotina. Una dosis informada por sí sola no puede definir la seguridad porque la formulación del suplemento, el tiempo, la exposición repetida, la depuración renal y los umbrales específicos de la plataforma difieren. El reconocimiento debe comenzar con un historial explícito de suplementos y evaluación de discordancia clínico-laboratorial. La confirmación puede requerir recogida después de un intervalo apropiado, medición con un método de arquitectura diferente, medición directa de biotina o un procedimiento de depleción validado localmente. Se deben evitar las reglas universales de eliminación y correcciones numéricas no validadas. La prevención efectiva depende de la comunicación coordinada entre médicos, laboratorios, fabricantes y pacientes, con especial atención a los paneles tiroideos y las vías del síndrome coronario agudo.

Palabras clave: Biotina. Interferencia en Inmunoensayo. Pruebas de Función Tiroidea. Troponina Cardíaca. Medicina de Laboratorio. Seguridad del Paciente.

1 INTRODUCTION

Biotin is a water-soluble vitamin that functions as a cofactor for carboxylases and is also used as a laboratory reagent because the streptavidin–biotin interaction is strong, specific, and readily adaptable to automated immunoassays.[1,2] Supplements marketed for hair, skin, and nail health frequently contain doses far above nutritional requirements, and patients may not report these products when asked only about prescription medicines.[1,13,30] Pharmacologic use and selected inherited metabolic disorders can produce circulating concentrations well beyond those associated with ordinary dietary intake.[1,9,16]

Many contemporary immunoassays use a biotinylated component and a streptavidin-coated solid phase to separate bound from unbound material.[1,2,7] When free biotin from the specimen competes with assay reagents, the reported result may depart from the patient's true analyte concentration even though routine internal quality-control material remains acceptable.[1,2,8] The usual direction is falsely increased in competitive assays and falsely decreased in noncompetitive sandwich assays, but actual susceptibility remains specific to the analyte, platform, reagent generation, specimen, and biotin concentration.[1,7,8,31]

Thyroid testing is especially vulnerable to a clinically coherent pattern of error because thyroid-stimulating hormone is usually measured with a sandwich format, whereas free thyroxine and free triiodothyronine are commonly measured with competitive formats.[3,4] A susceptible platform may therefore report suppressed thyroid-stimulating hormone together with increased free thyroid hormones, imitating biochemical hyperthyroidism rather than producing an obviously impossible set of values.[3,4,10–12] Thyroglobulin, thyroid antibodies, and other endocrine analytes may also be affected, with consequences for etiologic classification, cancer surveillance, and treatment.[1,3,4]

Cardiac troponin creates a different safety problem because most assays use sandwich architecture and excess biotin may lower the measured concentration.[18–20] A falsely low high-sensitivity troponin result can alter accelerated rule-out pathways for acute myocardial infarction when clinicians do not suspect analytical interference.[19–21] Susceptibility differs among troponin T and I methods and has changed with reagent redesign, so conclusions from one platform cannot be transferred automatically to another.[18,21–24]

Exposure is relevant in emergency and ambulatory care because detectable biotin has been found in clinical cohorts, although the proportion of specimens above an interference threshold is smaller than the proportion with any measurable biotin.[13–15,17] The presence of biotin does not by itself prove that a result is clinically biased because thresholds vary widely

between assays.[17,21,28] Conversely, a low reported supplement dose does not guarantee absence of interference because dose, timing, absorption, accumulation, renal function, and assay tolerance interact.[1,6,16,29]

Recognition is difficult when a biased panel resembles real disease, when clinicians are unaware that a supplement contains biotin, or when a laboratory operates both legacy and updated reagent generations.[3,10–12,22,23] Confirmation can involve repeat collection after interruption, testing with a method that does not use the same capture design, serial dilution, direct measurement of biotin, or validated streptavidin-based depletion.[1,9,25–27] Each strategy has limitations, and a manipulated specimen should not be reported quantitatively unless the procedure has been validated for that assay and matrix.[1,25–27]

The clinical literature combines controlled ingestion experiments, ex vivo spiking studies, platform comparisons, prevalence cohorts, case reports, and guidance documents, and these designs answer different questions.[1,5,7,13,18] Evidence about analytical bias should therefore be distinguished from evidence about threshold crossing, diagnostic misclassification, and documented patient harm.[1,17,21,28] An integrated appraisal is needed to translate heterogeneous laboratory findings into safe decisions for thyroid assessment and time-critical cardiac troponin testing.[1,3,20,27]

2 OBJECTIVE

To analyze the mechanisms, clinical manifestations, magnitude, recognition, and mitigation of biotin interference in thyroid function and cardiac troponin immunoassays, emphasizing assay-specific interpretation and practical communication between clinicians and laboratories.

3 METHODS

An integrative narrative review was conducted using PubMed-indexed literature available through September 2026. The evidence base was assembled from controlled oral-exposure studies, ex vivo interference experiments, analytical platform comparisons, emergency-department and outpatient prevalence cohorts, clinical case reports or series, review articles, and professional laboratory guidance. Search concepts combined biotin with immunoassay interference, streptavidin, thyroid-stimulating hormone, thyroid hormones, thyroglobulin, cardiac troponin, high-sensitivity troponin, washout, depletion, and mitigation.

Publications were retained when they described the direction or magnitude of interference, linked circulating or added biotin to a named assay, documented a clinical consequence, evaluated a mitigation procedure, or provided practice recommendations directly relevant to thyroid or cardiac troponin testing. Reports that discussed nutritional biotin without analytical outcomes, nonhuman matrices, or unrelated immunoassays without transferable methodological information were not used in the main synthesis. The final corpus contained 31 PubMed-indexed publications.

Data were organized by study design, exposure model, analyte, assay architecture, manufacturer or reagent generation, direction of bias, threshold crossing, clinical consequence, and mitigation strategy. Because exposure protocols, specimen preparation, interference limits, and assays were heterogeneous, no pooled quantitative estimate was calculated. Findings were synthesized qualitatively, with controlled in vivo studies used to inform real exposure and timing, spiking studies used to compare analytical susceptibility, prevalence studies used to estimate the frequency of exposure, and case reports used only to characterize possible clinical harm.

4 RESULTS AND DISCUSSION

4.1 EVIDENCE BASE AND INTERPRETATION OF STUDY DESIGNS

The literature consistently demonstrates that biotin interference is a property of a specific analytical system rather than a universal effect of the vitamin. Controlled ingestion studies provide the most direct link between a known oral dose and changes in results over time, but they usually involve healthy participants, short exposure, and a limited number of platforms.[4–6] Ex vivo spiking permits efficient comparison across assays and a broad concentration range, yet it does not reproduce absorption, distribution, endogenous metabolites, protein binding, or renal elimination.[7,8,18] Clinical prevalence cohorts establish that biotin is present in real-world specimens, but clinical relevance depends on whether the measured concentration exceeds the tolerance of the assay actually used.[13–15,17] Case reports establish plausibility of harm but cannot estimate incidence.[10–12]

This hierarchy explains why apparently conflicting conclusions can coexist. A platform may show pronounced bias in a high-concentration spiking experiment while producing little risk among unselected emergency-department patients, and an updated reagent may appear safe at concentrations that substantially affected its predecessor.[21–23] The appropriate question is therefore not whether biotin interferes with immunoassays in the abstract, but

whether the patient's circulating concentration at collection is high enough to affect the exact method and to move the result across a clinically important boundary.

Table 1

Representative PubMed-indexed evidence on biotin interference

Study	Design	Main contribution	Clinical interpretation
Li et al., 2017[5]	Controlled ingestion in healthy adults	Demonstrated changes across multiple hormone and nonhormone immunoassays after oral biotin	Real exposure can alter results without true physiological disease
Trambas et al., 2018[7]	Ex vivo platform evaluation	Characterized concentration-dependent bias in susceptible competitive and sandwich assays	Magnitude is analyte- and method-specific
Piketty et al., 2017[9]	High-dose exposure and depletion study	Documented false endocrine profiles and evaluated removal of interference	Alternate or depleted testing can confirm the mechanism
Ylli et al., 2021[4]	Prospective thyroid assay study	Compared thyroid hormones, thyroid-stimulating hormone, and thyroglobulin across methods	Both affected analytes and duration differ by platform
Zhang et al., 2020[6]	Prospective thyroid-function study	Assessed dose, timing, and washout on common platforms	A fixed interval cannot be generalized without method context
Katzman et al., 2018[13]	Outpatient survey and emergency specimens	Linked supplement use with measurable plasma biotin	Exposure is clinically plausible and often underreported
Gunsolus et al., 2021[14]	Five emergency-department cohorts	Measured detectable biotin across real-world samples	Any detectable biotin is not equivalent to clinically relevant bias
Frame et al., 2019[18]	Troponin assay comparison	Showed unequal susceptibility across cardiac troponin methods	Risk statements must identify the actual assay
Mumma et al., 2020[21]	Clinical risk assessment	Related measured biotin and high-sensitivity troponin T bias to diagnostic risk	Threshold crossing, not exposure alone, determines clinical concern
Mzougui et al., 2020[22]	New-generation assay evaluation	Evaluated updated troponin T and thyroid-stimulating hormone assays	Reagent redesign may substantially increase tolerance
von Meyer et al., 2021[23]	Updated hs-cTnT verification	Compared the performance of an assay with improved biotin tolerance	Laboratories should track reagent generation
Chiu et al., 2025[31]	Routine immunoassay assessment	Reassessed interference across contemporary assays	Local method verification remains necessary as platforms evolve

Designs are complementary. Spiking studies establish analytical susceptibility, ingestion studies establish real exposure effects, and clinical cohorts estimate how often relevant concentrations occur.

Source: Prepared by the authors.

4.2 ANALYTICAL MECHANISM AND DIRECTION OF ERROR

In a sandwich immunoassay, the analyte is captured between two antibodies, and signal generally rises with analyte concentration. If the assay relies on a biotinylated complex binding to streptavidin, excess free biotin can occupy streptavidin sites and reduce capture of the immune complex. The generated signal falls, and the instrument reports a falsely low analyte concentration.[1,2,7] Thyroid-stimulating hormone and many cardiac troponin assays use this general architecture, although individual designs and tolerance limits differ.

In a competitive assay, patient analyte and a labeled reagent compete for limited binding. The relation between signal and analyte is inverse; interference that prevents normal capture can therefore be interpreted as a higher analyte concentration.[1,2] Free thyroxine and free triiodothyronine are prominent clinical examples. The combined effect on sandwich and competitive tests can create the persuasive but artificial pattern of low thyroid-stimulating hormone and high thyroid hormones.[3,4,10–12]

The rule about direction is a useful warning, not a substitute for manufacturer data or local verification. Some methods do not use streptavidin–biotin capture, some incorporate steps that remove or dilute free biotin, and successive reagent generations can alter susceptibility.[1,22,23,31] Matrix effects, endogenous antibodies, hemolysis, and other interferences may coexist. In troponin testing, the combined effects of biotin and hemolysis may not be predicted by considering either factor alone, reinforcing the need to review the whole specimen and analytical context.[20,24]

Table 2

Typical direction and consequence of biotin interference

Assay context	Usual format	Typical reported effect	Potential consequence
Thyroid-stimulating hormone	Sandwich	Falsely decreased	Apparent hyperthyroidism or exaggerated treatment response
Free thyroxine / free triiodothyronine	Competitive	Falsely increased	Apparent thyrotoxicosis
Thyroglobulin	Often sandwich	Potentially falsely decreased	False reassurance in thyroid-cancer surveillance
Thyroid antibodies	Assay-dependent	Direction varies	False etiologic support or misleading autoimmune classification
Cardiac troponin	Usually sandwich	Potentially falsely decreased	Delayed or missed recognition of myocardial injury

The table describes common streptavidin–biotin designs, not every commercial method. Manufacturer documentation and local verification take precedence.[1,2,7]
Source: Prepared by the authors.

4.3 THYROID FUNCTION TESTS: FALSE HYPERTHYROIDISM AND BROADER ENDOCRINE ERROR

Thyroid panels are a common setting for recognition because the expected directions of error reinforce one another. Prospective studies in healthy adults have shown changes in thyroid-stimulating hormone, free thyroid hormones, thyroglobulin, and selected antibodies after biotin exposure, with important differences among platforms and collection times.[4–6] The changes are analytical rather than physiological: the participant can appear biochemically thyrotoxic while remaining clinically euthyroid.

Case reports illustrate the consequences of accepting the pattern at face value. Patients taking high-dose biotin have been evaluated for Graves disease, referred urgently, or considered for antithyroid treatment before the supplement history or alternate-platform testing exposed the discrepancy.[10–12] The most useful clues include weak correspondence between symptoms and laboratory severity, unexpectedly rapid normalization, discordant imaging or antibody results, disagreement between laboratories, and recent use of a hair or nail supplement. None of these clues is sufficiently sensitive to replace direct questioning.

The interference is not limited to a stereotyped three-test panel. Thyroglobulin can be falsely low on a susceptible sandwich assay and could create inappropriate reassurance during differentiated thyroid cancer follow-up.[1,4] Thyroid-receptor, thyroid-peroxidase, or thyroglobulin antibody assays may show assay-specific changes and can make a false biochemical pattern appear etiologically coherent.[3,4] Interpretation should therefore consider

the complete panel and the architecture of each component rather than assuming that all thyroid measurements move in the same direction.

When the patient is stable, the safest approach is usually to postpone interpretation, establish the product and last dose, consult the laboratory, and repeat testing after an interval tailored to exposure and method. If an immediate answer is required, a non-biotin method or an alternate analytical principle may be preferable. Treatment for apparent hyperthyroidism should not be initiated solely from a discordant panel before interference has been considered, unless the clinical situation independently requires urgent therapy.

4.4 CARDIAC TROPONIN: PLATFORM DEPENDENCE AND TIME-CRITICAL RISK

The theoretical concern in cardiac troponin testing is a falsely decreased result that contributes to premature exclusion of acute myocardial infarction. Comparative studies confirm that susceptibility varies substantially among assays; some troponin T or I methods are affected at attainable concentrations, whereas others show little or no relevant bias under the same experimental conditions.[18–21] Consequently, an alert that merely states “troponin is affected by biotin” is incomplete unless it identifies the platform and reagent generation.

Clinical risk is shaped by both analytical bias and the decision pathway. A small negative bias may be inconsequential when serial values are well above the diagnostic threshold, yet the same bias can matter near a rule-out cutoff or when a low initial value is interpreted with a short sampling interval.[20,21] A normal electrocardiogram or atypical pain does not validate a potentially biased troponin result, and suspected interference should not delay clinical assessment, repeat sampling, electrocardiography, or other indicated management of acute coronary syndrome.

Reagent redesign has reduced risk for some high-sensitivity troponin T systems. Evaluations of newer electrochemiluminescent assays and an updated high-sensitivity troponin T method found substantially improved biotin tolerance compared with earlier versions.[22,23] This is an important advance, but it does not eliminate the problem because hospitals may use different platforms across sites, legacy reagents may remain in circulation, and the same specimen may be tested for other biotin-sensitive analytes. The laboratory should maintain a current method inventory rather than rely on a historical class warning.

Direct clinical harm is harder to quantify than analytical susceptibility. Emergency-department studies found detectable biotin in a minority of samples, but relatively few specimens reached concentrations predicted to cause major bias in the examined

contemporary assay.[13,14,17,21] These findings argue against indiscriminate rejection of every specimen from a supplement user, while still supporting targeted precautions for high-dose exposure, renal impairment, very recent ingestion, implausible serial change, and assays with low interference thresholds.

4.5 DOSE, CIRCULATING CONCENTRATION, TIMING, AND WASHOUT

Daily dose is an imperfect surrogate for interference. Commercial products vary in content, adherence is uncertain, and the laboratory result reflects circulating biotin at the moment of sampling rather than the label dose.[1,16] Peak concentration depends on absorption and timing, while persistence depends on repeated administration, total dose, distribution, and renal elimination. The relationship is further modified by the analytical threshold of the specific assay.

Controlled studies demonstrate that the duration of measurable interference differs among thyroid tests and platforms after the same exposure.[4–6] High-dose therapy can require longer interruption than routine supplements, and impaired kidney function may plausibly prolong exposure. For these reasons, a single universal washout interval should not be presented as safe for every patient, dose, and assay.[1,6,16,28] Manufacturer instructions and laboratory-specific validation should guide the minimum interval whenever available.

The clinical urgency changes the response. Elective thyroid testing can often be deferred until a suitable interval has elapsed. Suspected acute myocardial infarction cannot be managed by waiting for supplement clearance; the laboratory and clinical team should identify an unaffected or more tolerant method, interpret serial results with caution, and continue the diagnostic pathway according to the patient's symptoms, electrocardiogram, and overall risk. Direct measurement of serum biotin can clarify exposure but is not routinely available with a turnaround time compatible with emergency decisions.

4.6 RECOGNITION, CONFIRMATION, AND MITIGATION

Prevention begins before phlebotomy. Medication reconciliation should ask specifically about vitamins, hair and nail products, energy or wellness supplements, multivitamins, and prescribed high-dose biotin. The product name, listed dose, frequency, last ingestion, reason for use, and renal status should be documented. General questions such as “Do you take any medications?” have low value because many patients classify supplements as foods or cosmetics rather than medicines.[1,13,27]

When interference is suspected, the clinician should contact the laboratory before acting on the isolated value. The laboratory can identify whether the method uses streptavidin–biotin chemistry, review the reagent version and manufacturer's interference claim, inspect earlier results, and select a confirmation strategy. Comparison with a platform that uses a different architecture is often more persuasive than repetition on the same system, provided that normal intermethod differences are considered.[1,26,27]

Biotin-depletion procedures can demonstrate interference by removing free biotin and retesting the specimen. Piketty and colleagues validated a simple streptavidin-based approach for endocrine samples, and later work evaluated dilution or depletion strategies for troponin and other assays.[9,25,26] These procedures can be valuable for investigation, but recovery, matrix effects, residual binding material, dilution error, and analyte-specific performance require local validation. A post-treatment result should not be released as a corrected patient value merely because it appears clinically plausible.

Serial dilution is similarly limited. Nonlinearity can suggest interference, but many immunoassays are not perfectly linear across the relevant range, and dilution changes the concentrations of both analyte and interferent. A normal dilution pattern does not exclude biotin, while an abnormal pattern is not specific. Dilution may be useful as part of a laboratory investigation, particularly when supported by a validated protocol, but it should not replace recollection or alternate-method testing when those options are feasible.[1,25]

System-level controls are more reliable than expecting every clinician to remember every susceptible assay. Effective measures include electronic prompts that name biotin explicitly, patient-facing instructions before scheduled testing, visible laboratory comments for vulnerable methods, automatic referral of discordant patterns for review, current tables of platform tolerance, and rapid communication routes for urgent specimens.[1,26,27] Laboratories should reassess alerts after reagent changes because an obsolete warning can create unnecessary delay, while failure to recognize a legacy method can create avoidable harm.[22,23,31]

Table 3

Practical response to suspected biotin interference

Step	Key question	Recommended action
Recognize	Does the result fit the history, examination, electrocardiogram, imaging, and prior trend?	Pause nonurgent interpretation and identify high-risk discordance
Clarify exposure	What product, dose, frequency, indication, last dose, and renal status apply?	Record the label or photograph; ask explicitly about hair and nail products
Identify method	Does the local assay use streptavidin–biotin capture, and which reagent generation is installed?	Contact the laboratory and review current interference claims
Protect urgent care	Would delay create harm, particularly in suspected acute coronary syndrome?	Continue clinical management; obtain an alternate or more tolerant method if possible
Confirm	Can a fresh specimen be collected after an appropriate interval?	Prefer recollection or alternate architecture; consider direct biotin measurement when available
Investigate	Is specimen manipulation necessary?	Use dilution or depletion only under a locally validated protocol
Communicate	Could another result from the same specimen be affected?	Notify the clinical team, annotate affected results, and review related analytes

The required interval and confirmation method are assay- and context-specific; no universal washout should be applied automatically.[1,26–28]
Source: Prepared by the authors.

4.7 LIMITS OF THE EVIDENCE AND PRIORITIES FOR PRACTICE

The evidence base has important limitations. Spiking studies use different matrices and definitions of acceptable bias; ingestion studies are small and often enroll healthy adults; case reports preferentially capture dramatic events; and prevalence cohorts may not represent patients receiving pharmacologic biotin. Assay generations change faster than many reviews are updated, and a manufacturer's nominal interference threshold does not reveal how often a result crosses a clinical decision boundary.

Future studies should report the exact instrument, reagent generation, specimen matrix, baseline analyte concentration, measured biotin concentration, absolute and relative bias, and the proportion of samples that cross prespecified clinical thresholds. Controlled studies should include repeated dosing, renal impairment, and time points relevant to real clinical workflows. Troponin investigations should evaluate accelerated diagnostic algorithms rather than analytical bias alone, while thyroid studies should distinguish biochemical change from actual treatment or imaging consequences.

Current practice need not wait for perfect evidence. The defensible approach is assay-specific: know the local method, ask explicitly about biotin, distrust severe biochemical abnormalities that do not fit the patient, and use validated confirmation pathways. This approach avoids both extremes—ignoring a genuine source of laboratory error and attributing every discordant immunoassay to biotin without adequate investigation.

5 CONCLUSION

Biotin interference is not a uniform effect of supplementation; it results from the interaction between circulating biotin and a susceptible assay design. The same exposure can produce marked error on one platform and negligible change on another, and successive reagent generations may behave differently.

In thyroid testing, the principal danger is a coherent false hyperthyroid pattern, with suppressed thyroid-stimulating hormone and increased free hormones, sometimes accompanied by misleading antibody or thyroglobulin results. Clinical–laboratory discordance and an explicit supplement history are central to recognition.

In cardiac troponin testing, the safety concern is false lowering in a time-critical diagnostic pathway. Suspected interference must not delay evaluation of acute coronary syndrome; it should prompt immediate laboratory consultation, serial clinical assessment, and use of an unaffected or sufficiently tolerant method when available.

No single washout interval is appropriate for every dose, patient, analyte, and platform. Recollection, alternate-method testing, direct biotin measurement, dilution, and depletion each have roles, but specimen manipulation and corrected-value reporting require local validation.

The most effective strategy is coordinated prevention: patient education, specific supplement reconciliation, assay inventories, current interference thresholds, and rapid clinician–laboratory communication. These measures preserve the speed of modern immunoassays while reducing avoidable diagnostic error.

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