MAYO CLINIC LABORATORIES

Test Definition: FRTUP

Free Thyroxine Index (FTI), Serum

Overview

Useful For

Estimating the amount of circulating free thyroxine (free thyroxine index) using the total thyroxine and thyroid binding capacity (T-uptake)

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
TUPC	Thyroxine Binding Capacity, S	No	Yes
T4S	Thyroxine, Total, S	Yes, (order T4)	Yes
FRTI	Free Thyroxine Index	No	Yes

Method Name

TUPC: Electrochemiluminescence Immunoassay (ECLIA)
T4S: Electrochemiluminescence (ECL)
FRTI: Calculation

NY State Available

Yes

Specimen

Specimen Type

Serum

Specimen Required

Patient Preparation:
1. For 12 hours before specimen collection do not take multivitamins or dietary supplements containing biotin (vitamin B7), which is commonly found in hair, skin, and nail supplements and multivitamins.
2. If patient is receiving treatment with lipid-lowering agents containing dextrothyroxine (D-T4), discontinue for 4 to 6 weeks prior to specimen collection.
Collection Container/Tube:
Preferred: Serum gel
Acceptable: Red top
Submission Container/Tube: Plastic vial
Specimen Volume: 1 mL
Collection Instructions: Centrifuge and aliquot serum into a plastic vial.

Specimen Minimum Volume

0.5 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	7 days	
	Ambient	72 hours	
	Frozen	30 days	

Clinical & Interpretive

Clinical Information

The determination of the total thyroxine (T4) concentration is of importance in laboratory diagnostics for differentiating between euthyroid, hyperthyroid, and hypothyroid conditions. As the major fraction of the total T4 is bound to transport proteins (thyroxine-binding globulin [TBG], prealbumin, and albumin), the determination of total T4 only provides correct information when the thyroxine-binding capacity (TBC) in serum is normal. The free thyroid hormones are in equilibrium with the hormones bound to the carrier proteins.

The TBC or T-uptake assay provides a measure of the available thyroxine-binding sites. Determination of the free thyroxine index (FTI) from the quotient of total T4 and thyroxine-binding index (ie, result of the T-uptake determination) takes into account changes in the thyroid hormone carrier proteins and the thyroxine level.

While total T4 is a relatively reliable indicator of T4 levels in the presence of normal binding proteins, it is not a reliable indicator when binding proteins are abnormal. For example, increases in thyroxine-binding proteins may cause increased total T4 levels despite normal free T4 levels and normal thyroid function.

Results are changed by drugs or physical conditions that alter the patient's TBG levels or drugs that compete with endogenous T4 and T3 for protein-binding sites.

Direct measurement of free thyroxine (FRT4 / T4 [Thyroxine], Free, Serum) has replaced the FTI test in most clinical situations.

Reference Values

THYROXINE BINDING CAPACITY (units are in Thyroxine Binding Index: TBI):
0-19 years: 0.8-1.2 TBI
> or =20 years: 0.8-1.3 TBI

T4 TOTAL (T4):
0-5 days: 5.0-18.5 mcg/dL
6 days-2 months: 5.4-17.0 mcg/dL
3-11 months: 5.7-16.0 mcg/dL
1-5 years: 6.0-14.7 mcg/dL
6-10 years: 6.0-13.8 mcg/dL
11-19 years: 5.9-13.2 mcg/dL
> or =20 years: 4.5-11.7 mcg/dL

FREE THYROXINE INDEX:
0-5 days: 5.1-20.8 mcg/dL
6 days-2 months: 5.5-18.0 mcg/dL
3-11 months: 5.7-16.8 mcg/dL
1-5 years: 5.9-15.0 mcg/dL
6-10 years: 6.0-13.9 mcg/dL
11-19 years: 5.9-13.2 mcg/dL
> or =20 years: 4.8-12.7 mcg/dL

For International System of Units (SI) conversion for Reference Values, see
www.mayocliniclabs.com/order-tests/si-unit-conversion.html

Interpretation

The free thyroxine index (FTI) is determined by the following calculation:
FTI =thyroxine (T4)/thyroid binding capacity

The FTI is a normalized determination that remains relatively constant in healthy individuals and compensates for abnormal levels of binding proteins.

Hyperthyroidism causes increased FTI, and hypothyroidism causes decreased values.

Cautions

This test cannot be used for patients receiving treatment with lipid-lowering agents containing dextrothyroxine (D-T4). If the thyroid function is to be checked in such patients, the therapy should first be discontinued for 4 to 6 weeks to allow the physiological state to become re-established.

Autoantibodies to thyroid hormones can interfere with the assay.

Binding protein anomalies seen with familial dysalbuminemic hyperthyroxinemia, for example, may cause values which, while characteristic of the condition, deviate from the expected results.

Clinical Reference

1. Whitley RJ, Meikle AW, Watts NB. Thyroid function. In: Burtis CA, Ashwood, ER, eds. Tietz Fundamentals of Clinical Chemistry. 4th ed. WB Saunders Company; 1996:645-646
2. Wilson JD, Foster DW, Kronenburg MD, et al. Williams Textbook of Endocrinology. 9th ed. WB Saunders Company; 1998:407-477
3. Freedman DB, Halsall D, Marshall WJ, Ellervik C. Thyroid disorders. In: Rifai N, Horvath AR, Wittwer CT, eds. Tietz

Textbook of Clinical Chemistry and Molecular Diagnostics. 6th ed. Elsevier; 2018:1572-1616
4. Ross DS, Burch HB, Cooper DS, et al. 2016 American Thyroid Association Guidelines for Diagnosis and Management of Hyperthyroidism and Other Causes of Thyrotoxicosis. Thyroid. 2016;26(10):1343-1421
5. Persani L, Cangiano B, Bonomi M. The diagnosis and management of central hypothyroidism in 2018. Endocr Connect. 2019;8(2):R44-R54. doi: 10.1530/EC-18-0515

Performance

Method Description

Thyroxine Binding Capacity:
Thyroxine (T4) occupies the free binding sites in the serum sample. After addition of a T4-specific antibody labeled with a ruthenium complex, the T4-polyhapten and the antibody derivative react to form a complex, the concentration of which is inversely proportional to the concentration of the excess, exogenous T4. This immunological complex becomes bound to the added streptavidin-coated microparticles via interaction of biotin and streptavidin. Application of a voltage to the electrode then induces chemiluminescent emission which is measured by a photomultiplier.(Package insert: T-Uptake reagent. Roche Diagnostics; V3, 10/2022)

Total Thyroxine:
The Roche Elecsys T4 assay is a competitive assay using electrochemiluminescence detection. Bound T4 is released from binding proteins by 8-anilino-1-naphthalene sulfonic acid. Patient specimen is incubated with sheep polyclonal anti-T4 antibody labeled with ruthenium. Streptavidin-coated microparticles and biotinylated T4 are added for a second incubation during which the still free binding sites of the labeled antibody become occupied. The resulting immunocomplex becomes bound to the solid phase by interaction of biotin and streptavidin. The reaction mixture is aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed and application of a voltage to the electrode induces the electrochemiluminescent emission. This signal is measured against a calibration curve to determine patient results.(Package insert: Elecsys T4. Roche Diagnostics; V 2.0, 01/2019)

PDF Report

No

Day(s) Performed

Monday through Sunday

Report Available

Same day/1 to 2 days

Specimen Retention Time

7 days

Performing Laboratory Location

Mayo Clinic Laboratories - Rochester Main Campus

Fees & Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification

This test has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information

84479-Thyroxine binding capacity
84436-Thyroxine total

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
FRTUP	Free Thyroxine Index(FTI), S	32215-6

Result ID	Test Result Name	Result LOINC® Value
T4S	Thyroxine, Total, S	83119-8
TUPC	Thyroxine Binding Capacity, S	74795-6
FRTI	Free Thyroxine Index	32215-6