FT4 *i*Clia

Chemiluminescence microparticles immunoassay for quantitative detection of free thyroxine (FT4) in human serum/plasma

1. INTRODUCTION

Free thyroxine (FT4) is expressed by follicular cells of thyroid epithelium. It widely acts on multiple organs, promotes cell division, plays an important role in metabolism, growth, development, and is also associated with a variety of diseases. Healthy human blood contains only small amounts of FT4. Hyperthyroidism, hyperTBG (thyroid-binding globulin), nodular toxic goiter, etc., blood levels of FT4 are significantly elevated, and low FT4 levels are often associated with hypothyroidism, hypoTBG, hypopituitarism. And the level of FT4 is not affected by thyroxine globulin, therefore, free thyroxine becomes the most important laboratory method for the diagnosis of thyroid dysfunction.

2. INTENDED USE

FT4 iClia is a chemiluminescent microparticle immunoassay for the quantitative detection of free thyroxine (FT4) in human serum/plasma. Clinically, it is mainly used to evaluate thyroid function. The assay kit is intended for in vitro diagnostic use.

3. PRINCIPLE

FT4 iClia is a "competitive" immunoassay using microparticle acridinium ester-labeled Chemiluminescent technology.

In the first step, anti-FT4 antibody labeled magnetic microparticle and human serum/plasma are mixed and incubated in an assay tube. Next, FT4 conjugated acridinium ester is added and combined, AE labels FT4 and FT4 in sample compete for the binding site of anti-FT4 antibody on the binding magnetic particle, and the Microparticle FT4 antibody/ free FT4 immune complex is kept with the help of a magnetic separator. Unbound acridinium ester and other substance are removed by washing and finally the bound enzyme is detected by addition of Pre-Trigger Solution and Trigger Solution. The relative light unit (RLU) intensity is inversely proportional to the amount of FT4. According to the FT4 RLU-concentration standard curve, the RLU tested can be interpreted to FT4 concentration in the sample expressed as pmol/L.

For quantitative testing of free thyroxine (FT4), the FT4 iCLIA assay utilizes a predefined lot-specific Master Curve which is uploaded into the instrument through the reagent Master Calibration Curve barcode. Based on the Master Curve and results obtained by running two Calibrators, an instrument specific Working Curve is created, which is used to calculate pmol/L from the RLU obtained for each sample.

4. DESCRIPTION OF SYMBOLS USED

The following are graphical symbols used in or found on J. Mitra diagnostic products and packing. These symbols are the most common ones appearing on medical devices and their packing. They are explained in more detail in the European Standard EN ISO 15223-1:2021.

	Manufactured By	IVD	*In vitro* diagnostic medical device
Σ	No. of tests		See Instruction for use
LOT	Lot Number Batch Number	2°C 8°C	Temperature Limitation
	Manufacturing Date		Caution - See instruction for use
	Expiry Date	REF	Catalogue Number
	Do not use if package is damaged		Keep away from sunlight
BIO	Contains biological Material of Human Origin	BIO	Contains biological Material of Animal Origin
IN	Country of Manufacture		Keep Dry

5. KIT PRESENTATION

- 50 Test Pack
- 100 Test Pack

6. KIT & ITS COMPONENTS

COMPONENT	DESCRIPTION
Microparticles Buffer	Magnetic microparticles coated with anti-FT4 antibodies with preservatives.
Assay Buffer	Buffer containing protein stabilizer and perservatives.
AE Conjugate	Containing FT4 linked to acridinium ester with preservatives.
Control-1 (Q1)	Low concentration of FT4 in Human Serum containing preservatives.
Control-2 (Q2)	High concentration of FT4 in Human Serum containing preservatives.
Calibrator-1 (C0)	Low concentration of FT4 in Human Serum containing preservatives.
Calibrator-2 (C1)	High concentration of FT4 in Human Serum containing preservatives.
Reagent Sealers	Adhesive sheets to cover the opened reagents.

7. STORAGE AND STABILITY

The shelf-life of the kit is 12 months from the date of manufacturing, when stored at 2-8°C. **Once the kit is opened, onboard stability of reagents, calibrator and control is 30 days at 2-8°C.**

8. ADDITIONAL MATERIAL AND INSTRUMENTS REQUIRED

- **Pre-Trigger Solution:** Hydrogen peroxide solution.
- **Trigger Solution:** Sodium hydroxide solution.
- **Wash Buffer:** Phosphate buffered saline solution with surfactant.
- **Assay Cup**
- **Sample Diluent (optional)**
- **CLIA 181 Analyzer**

All materials and analyzer to be used for running the FT4 iClia shall be from J. Mitra & Co. Pvt. Ltd.

9. SPECIMEN COLLECTION & HANDLING

1. Only human serum or plasma samples should be used for the test.
2. For serum collection use serum vacutainer. While preparing serum samples, remove the serum from the clot as soon as possible to avoid hemolysis. Fresh serum/plasma samples are preferred.
3. For plasma collection: use Dipotassium EDTA, Tripotassium EDTA, Sodium heparin and lithium heparin gel vacutainer.
4. Specimens should be free of microbial contamination and may be stored at 2-8°C for one week, or frozen at -20°C or lower. Avoid repeated freezing and thawing.
5. Do not use heat inactivated samples as their use may give false results. Hemolyzed and Icteric hyperlipemic samples may give erroneous results.
6. Serum specimens from patients receiving anticoagulant or thrombolytic therapy may contain fibrin due to incomplete clot formation.
7. Always use clear specimens. Centrifuge viscus/ thick or turbid specimen at 10,000 RPM for 15 minutes prior to use to avoid inconsistent result.
8. Use of disposable pipettes or pipette tips is recommended to prevent cross contamination.

10. SPECIMEN PROCESSING

(A) FROZEN SAMPLE

FT4 iClia test is best used with fresh samples that have not been frozen and thawed. However most frozen samples will perform well if the procedure suggested below is followed.

Allow the frozen sample to thaw in a vertical position in the rack. Do not shake the sample. This allows particles to settle to the bottom. Centrifuge the sample at 10,000 rpm for 15 minutes.

(B) TRANSPORTATION

If the specimen is to be transported, it should be packed in compliance with the current Government regulations regarding transport of aetiologic agents.

11. WARNING & PRECAUTION

⚠ **CAUTION:** THIS KIT CONTAINS MATERIALS OF HUMAN ORIGIN. NO TEST METHOD CAN OFFER COMPLETE ASSURANCE THAT HUMAN BLOOD PRODUCTS WILL NOT TRANSMIT INFECTION. NEGATIVE CONTROL, POSITIVE CONTROL & ALL THE SAMPLES TO BE TESTED SHOULD BE HANDLED AS THOUGH CAPABLE OF TRANSMITTING INFECTION.

1. The use of disposable gloves and proper biohazardous clothing is STRONGLY RECOMMENDED while running the test.

2. In case there is a cut or wound in hand, DO NOT PERFORM THE TEST.
3. Do not smoke, drink or eat in areas where specimens or kit reagents are being handled.
4. Tests are for *in vitro* diagnostic use only and should be run by competent person only.
5. Do not pipette by mouth.
6. All materials used in the assay and samples should be decontaminated in 5% sodium hypochlorite solution for 30-60 min. before disposal or by autoclaving at 121°C at 15psi for 60 minutes. Do not autoclave materials or solution containing sodium hypochlorite. They should be disposed off in accordance with established safety procedures.
7. Wash hands thoroughly with soap or any suitable detergent, after the use of the kit. Consult a physician immediately in case of accident or contact with eyes, in the event that contaminated material are ingested or come in contact with skin puncture or wounds.
8. Spills should be decontaminated promptly with Sodium Hypochlorite or any other suitable disinfectant.

12. PRECAUTIONS FOR USE & REAGENT HANDLING

1. Do not use kit components beyond the expiration date which is printed on the kit.
2. Store the reagents & samples at 2-8°C.
3. Do not pool reagents from within a batch or between different batches, as they are optimised for individual batch to give best results.
4. Before loading the reagent kit in the clia analyzer for the first time, ensure proper mixing of microparticle bottle to resuspend microparticles that may have settled during transport or storage.
5 Once reagents are opened, reagent Sealer must be used to prevent reagent evaporation and contamination and to ensure reagent integrity. Reliability of assay results cannot be guaranteed if reagent sealers are not used according to the instructions given.
6. Mark the test specimen with patient's name or identification number. Improper identification may lead to wrong result reporting.
7 To avoid contamination, wear clean gloves when placing a reagent sealer on an uncapped reagent bottle.
8. Once a reagent sealer has been placed on an open reagent bottle,do not invert the bottle as this will result in reagent leakage and may compromise assay results.
9. Reagents may be stored on or off the Chemiluminescence immunoassay analyzer. If reagents are removed from the analyzer, store them at 2-8°C (with Reagent Sealers) in an upright position. For reagents stored off the system, it is recommended that they should be stored in their original trays and boxes to ensure they remain upright. If the microparticle bottle does not remain upright (with a Reagent Sealer placed) while in refrigerated storage off the system, the reagent kit must be discarded.
10. Run FT4 Control-1 & FT4 Control-2 in each assay to evaluate validity of the kit.
11. Distilled or deionised water must be used for wash buffer preparation.
12. Avoid strong light exposure during the assay.
13. In case of any doubt the run should be repeated.

13. TEST PROCEDURE

Assay Procedure

1. Refer to the Clia-181 user manual for detailed information on preparing the analyzer.
2. Before loading the FT4 iClia reagent tray on the analyzer for the first time, mix contents of the microparticle buffer bottle to resuspend microparticles that may have settled during transporation/ storage. Once the microparticles have been loaded, no further mixing is required.

Note: Swirl the microparticle buffer bottle. Visually inspect the bottle to ensure microparticles are resuspended. If microparticles are still adhered to the bottle, mix the contents of the microparticles buffer bottles till they are completely resuspended. If the microparticles do not resuspend, DO NOT USE. Once the microparticles have been resuspended, place a reagent sealer on the bottle.

3. Load the FT4 iClia reagent tray on the Chemiluminescence immunoassay analyzer.
4. Verify that all necessary reagents are available in the reagent tray.
5. Ensure that adequate sample volume (not less than 250 μL) is present in sample tube prior to running the test.
6. Sample volume required for each additional test from same sample tube is 15μL.
7. The FT4 test-specific parameters are stored in reagent barcode placed on the reagent tray and read through barcode reader. In cases, the barcode cannot be read, contact customer support at: 011-47130300, 500 or write us at: jmitra@jmitra.co.in.
8. Run calibration, if required.
9. Mix FT4 iClia calibrators and controls by gentle inversion before use. Open the the cap and place the FT4 Calibrator-1 & FT4 Calibrator-2 and FT4 Control-1 & FT4 Control-2 vials into each respective sample positions. Read the barcode for calibrator and controls provided with the kit.
10. Press START. The test result for first sample will be obtained at 30 minutes.
11. The Chemiluminescence immunoassay analyzer performs all the functions automatically and calculate the results.

Calibration

1. Traceability: This assay has been standardized against the Roche FT4 reagent kit.
2. Every FT4 iClia kit has a two-dimension code label containing the predefined master curve of the particular reagent lot.
3. Test all both Calibrators in duplicate. Both FT4 Control-1 and FT4 Control-2 must be tested in each run to evaluate the assay calibration. Ensure that controls values are within the validity range specified in the FT4 iClia QC data sheet.
4. Once calibration is accepted (within range) and stored, all subsequent samples may be tested without further calibration unless:
5. Recalibrate the analyzer in following conditions:

a) After each exchange/use of new lot (Test reagent and pritrigger/ Trigger solution/ wash buffer).
b) Every 15 days and/or at the time of any component to be changed.
c) Controls are out of validation range.
d) Required by pertinent regulations.
e) After specified service procedures have been performed or maintenance to critical part or subsystems that might influence the performance of the FT4 iClia.

RESULT CALCULATION:

The analyzer automatically calculates the concentration of each sample. The results are given in pmol/L.

RESULT INTERPRETATION

If sample concentration is lower than the lower limit of the linear range, report the result < 2.00 pmol/L, while > 100.00 pmol/L when it is higher than the upper limit of linear range.

DETERMINATION OF REFERENCE RANGE

Each laboratory should establish its own range of normal value. The values given below are only indicative.

Reference Interval of this assay is considered as 9.03 - 24.5 pmol/L for healthy people, which is established referring to literatures, based on the rest results of more than 60 clinical samples.

Due to the differences in geography, race, gender or age, it is suggested each laboratory establish its own reference interval or conduct verification of the existing reference interval.

14. PERFORMANCE CHARACTERISTICS

- Assay results obtained in individual laboratories may vary from data presented in this product insert.

Limit of Blank (LoB)

- The Limit of Blank was determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP17-A requirements.
- The Limit of Blank is the 95th percentile value from n >20 measurements of analyte free samples over several independent series. The Limit of Blank corresponds to the concentration below which analyte-free samples are found with a probability of 95%.
- The observed LoB value was < 1.5 pmol/L.

Accuracy: The accuracy of FT4 iClia was detected with 60 clinical specimens and compared with Roche CLIA. The co-relation co-efficient is >0.990.

Precision

Intra Assay Variation

Within run variation was determined by 10 replicate measurements of two different FT4 control sera(Low) and (High) in one assay in 3 different lots. The within assay variability is <10 %.

Inter Assay Variation

Between run variation was determined by 2 replicate measurements in 10 sequential days of two different FT4 Control-1 (Low) and FT4 Control-2 (High) in 3 different lots.The between assay variability is <10.0%.

Inter machine(CLIA-181 Analyzer) Variation 2

Between machine variation was determined by 2 replicate measurements of two different FT4 control-1 (Low) and FT4 control-2 (High)in 3 different lots in 3 different CLIA-181 Analyzer. The between machine variability is <15.0 %.

Intra-Assay, n=10			Inter-Assay, n=10×2		
Control	Mean (pmol/L)	CV	Sample	Mean (pmol/L)	CV
1	9.8	5.77%	1	10.14	8.53%
2	40.12	5.58%	2	41.57	8.54%

Linearity

The linearity was determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP6-A requirements.

The linearity range was verified by more than 6 concentration levels which encompass or be equal to the minimum and the maximum values of linearity range and duplicate assays in triplicate in single run for each lot at all 6 levels.

The FT4 iClia kit has been demonstrated to be linear from is 2.0 pmol/L to 100.00pmol/L., regression (R^2) of more than >0.990.

Analytical specificity

Cross-Reactivity

A study was performed based on guidance from CLSI EP7-A2.

The cross-reactants listed below (Using FT4-free samples) were evaluated to determine whether FT4 concentrations were affected when using the FT4 iClia (Free Thyroxine Hormone assay) kit.

Cross-Reactant	Cross-ReactantConcentration	Results
T3	200 ng/mL	< 0.029 pmol/L
rT3	100 ng/mL	< 0.029 pmol/L
T2	200 ng/mL	< 0.029 pmol/L

Interference

Potentially interfering substances were evaluated to determine whether FT4 concentrations were affected when using the FT4 iClia (Free Thyroxine Hormone assay) kit. Samples containing the potential interferents were prepared at two FT4 concentrations. The samples were assayed, and the FT4 concentrations of the spiked samples were compared to the reference samples.

Potential Interferent	Interferent Concentration	% Interferent Bias
Bilirubin	20 mg/dL	<10%
Hb	500 mg/dL	<10%
Intralipid	1000 mg/dL	<10%
Total protein	10 g/dL	<10%
RF	1000IU/mL	< 10%
ANA	400AU/mL	< 10%
HAMA	600ng/mL	< 10%

15. LIMITATION OF THE TEST

- The FT4 iCia should be used for detection of FT4 in serum or plasma only and not in other body fluids.
- Results should be used in conjunction with other data; e.g., symptoms, results of other tests, and clinical impressions.
- If the FT4 results are inconsistent with clinical evidence, additional testing is recommended.
- Specimens from patients who have received preparations of mouse monoclonal antibodies for diagnosis or therapy may contain human anti-mouse antibodies (HAMA). Such specimens may show either falsely elevated or depressed values when tested with assay kits that employ mouse monoclonal antibodies. Additional information may be required for diagnosis.
- Heterophilic antibodies in human serum can react with reagent immunoglobulins, interfering with in vitro immunoassays. Patients routinely exposed to animals or to animal serum products can be prone to this interference, and anomalous values may be observed. Additional information may be required for diagnosis.

16. LIMITED EXPRESSED WARRANTY DISCLAIMER

The manufacturer limits the warranty to the test kit, as much as that the test kit will function as an *in vitro* diagnostic assay within the limitations and specifications as described in the product instruction-manual, when used strictly in accordance with the instructions contained therein. The manufacturer disclaims any warranty expressed or implied including such expressed or implied warranty with respect to merchantability, fitness for use or implied utility for any purpose. The manufacture's liability is limited to either replacement of the product or refund of the purchase price of the product and in no case liable to for claim of any kind for an amount greater than the purchase price of the goods in respect of which damages are likely to be claimed.

The manufacturer shall not be liable to the purchaser or third parties for any injury, damage or economic loss, howsoever caused by the product in the use or in the application there of.

17. REFERENCES

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5. US Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1910.1030, Occupational Exposure to Bloodborne Pathogens. Jan 2001.
6. World Health Organization. Laboratory Biosafety Manual. Geneva: World Health Organization. 2004.

18. TROUBLE SHOOTING CHART

PROBLEM	POSSIBLE CAUSE	SOLUTION
1. Controls out of validation limit	a) Controls/ calibrator deterioration due to improper storage or used after expiry.	Use controls/ calibrator within 30 days once opened and Check storage temp. It should be 2-8^{0}C.
	b) Cross contamination of Controls	Pipette carefully and do not interchange caps.
	c) Reagents deterioration due to improper storage or used after expiry.	Use reagents within 30 days once opened and Check storage temp. It should be 2-8^{0}C.
2) High FT4 test results	a) Use of turbid, lipaemic or hemolyzed sample.	Use clear fresh sample. Refer specimen collection, handling and processing for more details.
	b) Sample position is wrongly defined while loading the sample details in analyzer.	check the sample position and run the test meticulously.
3) Low FT4 results	a)Sample deterioration due to improper Storage or microbially contaminated sample.	Use clear fresh sample immediately after collection. Refer Specimen collection, and handling processing for more details.
	b) Sample position is wrongly defined while loading the sample details in analyzer.	check the sample position and run the test meticulously.
	c) Magnetic microsphere are not properly mixed before loading in the analyzer.	Ensure proper mixing of bottle containing microparticles by gentle shaking/ inversion before use.

in vitro diagnostic Reagent, not for medicinal use

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