



fT4

KAPDB4340

LOT : 110225/1

**ft4****en**

For the direct quantitative determination of Free Thyroxine by enzyme immunoassay in human serum.

KAPDB4340

IN VITRO DIAGNOSTIC

DIASource ImmunoAssays SA - Rue du Bosquet 2, B-1348 Louvain-la-Neuve, Belgium - Tel: +32 10 84 99 11 - Fax : +32 10 84 99 90

INTENDED USE

For the direct quantitative determination of Free Thyroxine by enzyme immunoassay in human serum.
For *in vitro* diagnostic use only.

PRINCIPLE OF THE TEST

The principle of the following enzyme immunoassay test follows the typical competitive binding scenario. Competition occurs between an unlabeled antigen (present in calibrators, control and patient samples) and an enzyme-labelled antigen (conjugate) for a limited number of antibody binding sites on the microwell plate. The washing and decanting procedures remove unbound materials. After the washing step, the enzyme substrate is added. The enzymatic reaction is terminated by addition of the stopping solution. The absorbance is measured on a microtiter plate reader. The intensity of the colour formed is inversely proportional to the concentration of ft4 in the sample. A set of calibrators is used to plot a calibration curve from which the amount of ft4 in patient samples and controls can be directly read.

The labeled T4 (conjugate) employed in this assay system has shown no binding properties towards thyroxine-binding globulin (TBG) and human serum albumin (HSA). The binding sites on the microwell plates are designed to be of a low binding-capacity in order not to disturb the equilibrium between T4 and its carrying proteins. The assay is carried out under normal physiological conditions of pH, temperature and ionic strength.

CLINICAL APPLICATIONS

Thyroxine (T4), the principal thyroid hormone, circulates in blood almost completely bound to carrier proteins. However, only the free (unbound) fraction of thyroxine is considered to be biologically active. The main carriers of thyroxine are thyroxine-binding globulin (TBG), pre-albumin and albumin. The measurement of free thyroxine (ft4) levels correlate better with the clinical status than total thyroxine levels.

The DIASource free T4 assay is a one step competitive ELISA system that is rapid and easy to perform compared to equilibrium dialysis and ultrafiltration methods, which are cumbersome and time-consuming. This system employs a highly specific monoclonal antibody and a non-analog tracer that was proved experimentally to have no significant binding to TBG and albumin.

In the euthyroid, normal population the free T4 concentration is 7 – 22 pg/ml. The level of free T4 is decreased in hypothyroidism while in thyrotoxic patients the level of free T4 is increased.

This assay is used at times with other thyroid tests for *in vitro* diagnostic purposes and for assessing patients who are receiving thyroid treatments (follow-up).

PROCEDURAL CAUTIONS AND WARNINGS

1. Users should have a thorough understanding of this protocol for the successful use of this kit. Reliable performance will only be attained by strict and careful adherence to the instructions provided.
2. Control materials or serum pools should be included in every run at a high and low level for assessing the reliability of results.
3. When the use of water is specified for dilution or reconstitution, use deionized or distilled water.
4. In order to reduce exposure to potentially harmful substances, gloves should be worn when handling kit reagents and human specimens.
5. All kit reagents and specimens should be brought to room temperature and mixed gently but thoroughly before use. Avoid repeated freezing and thawing of reagents and specimens.
6. A calibration curve must be established for every run.
7. The control should be included in every run and fall within established confidence limits.
8. Improper procedural techniques, imprecise pipetting, incomplete washing as well as improper reagent storage may be indicated when assay values for the control do not reflect established ranges.
9. When reading the microplate, the presence of bubbles in the microwells will affect the optical densities (ODs). Carefully remove any bubbles before performing the reading step.
10. The substrate solution (TMB) is sensitive to light and should remain colourless if properly stored. Instability or contamination may be indicated by the development of a blue colour, in which case it should not be used.
11. When dispensing the substrate and stopping solution, do not use pipettes in which these liquids will come into contact with any metal parts.

12. To prevent contamination of reagents, use a new disposable pipette tip for dispensing each reagent, sample, calibrator and control.
13. Do not mix various lot numbers of kit components within a test and do not use any component beyond the expiration date printed on the label.
14. Kit reagents must be regarded as hazardous waste and disposed of according to national regulations.

LIMITATIONS

determination of ft4 in human serum. The kit is not calibrated for the determination of ft4 in other specimens of human or animal origin.

2. Do not use grossly hemolyzed, grossly lipemic, icteric or improperly stored serum.
3. Any samples or control sera containing azide are not compatible with this kit, as they may lead to false results.
4. Samples reading higher than 100 pg/ml should be reported as such and should not be diluted. Dilution will alter the existing equilibrium and may lead to false results.
5. The interpretation of free T4 results can be complicated by a variety of drugs, severe nonthyroidal illness and some rare conditions such as familial dysalbuminemic hyperthyroxinemia (FDH). For diagnostic purposes, the results of this assay should always be used in combination with the clinical examination, medical history and other findings.
6. Some individuals may have antibodies to mouse protein that can possibly interfere in this assay. Therefore, the results from any patients who have received preparation of mouse antibodies for diagnosis or therapy should be interpreted with caution.

SAFETY CAUTIONS AND WARNINGS

POTENTIAL BIOHAZARDOUS MATERIAL

Human serum that may be used in the preparation of the calibrators and control has been tested and found to be non-reactive for Hepatitis B surface antigen and has also been tested for the presence of antibodies to HCV and Human Immunodeficiency Virus (HIV) and found to be negative. However no test method can offer complete assurance that HIV, HCV and Hepatitis B virus or any infectious agents are absent. The reagents should be considered a potential biohazard and handled with the same precautions as applied to any blood specimen.

CHEMICAL HAZARDS

Avoid contact with reagents containing TMB, hydrogen peroxide and sulfuric acid. If contacted with any of these reagents, wash with plenty of water. TMB is a suspected carcinogen.

SPECIMEN COLLECTION AND STORAGE

Approximately 0.1 ml of serum is required per duplicate determination. Collect 4-5 ml of blood into an appropriately labelled tube and allow it to clot. Centrifuge and carefully remove the serum layer. Store at 4°C for up to 24 hours or at -10°C or lower if the analyses are to be done at a later date. Consider all human specimens as possible biohazardous materials and take appropriate precautions when handling.


SERUM PRETREATMENT

This assay is a direct system; no specimen pretreatment is necessary.

REAGENTS AND EQUIPMENT NEEDED BUT NOT PROVIDED

1. Precision pipettes to dispense 25, 100, 150 and 300 µl
2. Disposable pipette tips
3. Distilled or deionized water
4. A 37°C incubator
5. Microwell plate reader with a filter set at 450nm and an upper OD limit of 3.0 or greater* (see assay procedure step 11).

REAGENTS PROVIDED

 **Mouse Anti-ft4 Antibody Coated Microwell Plate-Break Apart Wells**
- Ready To Use.

Contents: One 96 well (12x8) monoclonal antibody-coated microwell plate in a resealable pouch with desiccant.

Storage: Refrigerate at 2-8°C

Stability: 12 months or as indicated on label.

Ag	HRP	CONC
----	-----	------

ft4-Horseradish Peroxidase (HRP) Conjugate Concentrate - X50

Contents: ft4-HRP conjugate in a protein-based buffer with a non-mercury preservative.
 Volume: 300 µl/vial
 Storage: Refrigerate at 2-8°C
 Stability: 12 months or as indicated on label.
 Preparation: Dilute 1:50 in assay buffer before use (eg. 40 µl of HRP in 2 ml of assay buffer). If the whole plate is to be used dilute 240 µl of HRP in 12ml of assay buffer. Discard any that is left over.

CAL	N
-----	---

ft4 Calibrators - Ready To Use. N = 0 to 4

Contents: Five vials containing ft4 in a human serum-based matrix with a non-mercury preservative. Prepared by spiking serum with a defined quantity of T4.
 *Listed below are approximate concentrations, please refer to vial labels for exact concentrations.

Calibrator	Concentration	Volume
Calibrator 0	0 pg/ml	0.5 ml
Calibrator 1	2 pg/ml	0.5 ml
Calibrator 2	9 pg/ml	0.5 ml
Calibrator 3	29 pg/ml	0.5 ml
Calibrator 4	95 pg/ml	0.5 ml

Storage: Refrigerate at 2-8°C
 Stability: 12 months in unopened vials or as indicated on label. Once opened, the calibrators should be used within 14 days or aliquoted and stored frozen. Avoid multiple freezing and thawing cycles.

CONTROL

Control - Ready To Use.

Contents: One vial containing ft4 in a human serum-based matrix with a non-mercury preservative. Prepared by spiking serum with a defined quantity of T4. Refer to vial label for expected value and acceptable range.
 Volume: 0.5 ml/vial
 Storage: Refrigerate at 2-8 °C
 Stability: 12 months in unopened vial or as indicated on label. Once opened, the control should be used within 14 days or aliquoted and stored frozen. Avoid multiple freezing and thawing cycles.

WASH	SOLN	CONC
------	------	------

Wash Buffer Concentrate - X10

Contents: One bottle containing buffer with a non-ionic detergent and a non-mercury preservative.
 Volume: 50 ml/bottle
 Storage: Refrigerate at 2-8°C
 Stability: 12 months or as indicated on label.
 Preparation: Dilute 1:10 in distilled or deionized water before use. If the whole plate is to be used dilute 50 ml of the wash buffer concentrate in 450 ml of water.

ASS	BUF
-----	-----

Assay Buffer - Ready To Use.

Contents: One vial containing a protein-based buffer with a non-mercury preservative.
 Volume: 15 ml/vial
 Storage: Refrigerate at 2-8°C
 Stability: 12 months or as indicated on label.

CHROM	TMB
-------	-----

TMB Substrate - Ready To Use.

Contents: One bottle containing tetramethylbenzidine and hydrogen peroxide in a non-DMF or DMSO containing buffer.
 Volume: 16 ml/bottle
 Storage: Refrigerate at 2-8°C
 Stability: 12 months or as indicated on label.

STOP	SOLN
------	------

Stopping Solution - Ready To Use.

Contents: One vial containing 1M sulfuric acid.
 Volume: 6 ml/vial
 Storage: Refrigerate at 2-8°C
 Stability: 12 months or as indicated on label.

ASSAY PROCEDURE

Specimen Pretreatment: None.

All reagents must reach room temperature before use. Calibrators, controls and specimen samples should be assayed in duplicate. Once the procedure has been started, all steps should be completed without interruption.

1. Prepare working solutions of the ft4-HRP conjugate and wash buffer.
2. Remove the required number of microwell strips. Reseal the bag and return any unused strips to the refrigerator.
3. Pipette 25 µl of each calibrator, control and specimen sample into correspondingly labelled wells in duplicate.
4. Pipette 100 µl of the conjugate working solution into each well (We recommend using a multichannel pipette).
5. Gently shake the plate for 10 seconds.
6. Incubate the plate at 37°C for 1 hour.
7. Wash the wells 3 times with 300 µl of diluted wash buffer per well and tap the plate firmly against absorbent paper to ensure that it is dry (The use of a washer is recommended).
8. Pipette 150 µl of TMB substrate into each well at timed intervals.
9. Incubate the plate at 37°C for 10-15 minutes (or until calibrator 0 attains dark blue colour for desired OD).
10. Pipette 50 µl of stopping solution into each well at the same timed intervals as in step 8.
11. Read the plate on a microwell plate reader at 450 nm within 20 minutes after addition of the stopping solution.

* If the OD exceeds the upper limit of detection or if a 450 nm filter is unavailable, a 405 or 415 nm filter may be substituted. The optical densities will be lower, however, this will not affect the results of patient/control samples.

CALCULATIONS

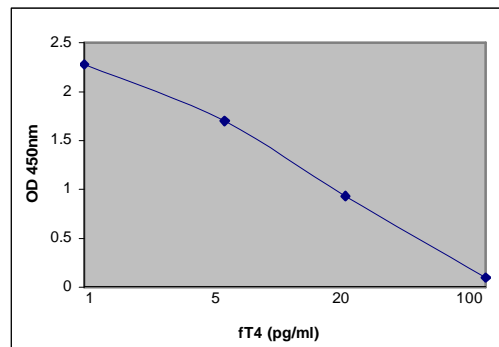
1. Calculate the mean optical density of each calibrator duplicate.
2. Draw a calibration curve on semi-log paper with the mean optical densities on the Y-axis and the calibrator concentrations on the X-axis. If immunoassay software is being used, a 4-parameter curve is recommended.
3. Calculate the mean optical density of each unknown duplicate.
4. Read the values of the unknowns directly off the calibration curve

TYPICAL ft4 TABULATED DATA

Calibrator	OD 1	OD 2	Mean OD	Value (pg/ml)
0	2.427	2.429	2.516	0
1	2.278	2.284	2.281	2
2	1.920	1.888	1.904	9
3	1.120	1.096	1.108	29
4	0.351	0.349	0.350	95

TYPICAL CALIBRATION CURVE

Sample curve only. Do not use to calculate results.



PERFORMANCE CHARACTERISTICS SENSITIVITY

The lower detection limit is calculated from the calibration curve by determining the resulting concentration of the mean OD of Calibrator 0 (based on 10 replicate analyses) minus 2 SD. Therefore, the sensitivity of the DIAsource Direct ft4 ELISA kit is **1.0 pg/ml**.

SPECIFICITY (CROSS REACTIVITY)

The following compounds were tested for cross-reactivity with the Direct ft4 ELISA kit with T4 cross-reacting at 100%.

Compound	%Cross Reactivity
L-Thyroxine	100
D-Thyroxine	94
3,3',5'-Triiodo-L-Thyronine (Reverse T3)	86
3,3',5'-Triiodo-L-Thyronine (T3)	3.3
3,3',5'-Triiodo-D-Thyronine	1.8
3,3',5'-Triiodothyropropionic acid	0.6

The following compounds were tested but cross-reacted at less than 0.04%: Acetylsalicylic acid, 3,5-Diiodo-L-Thyronine, 3,5-Diiodo-L-Tyrosine and 3-Iodo-L-Tyrosine.

INTRA-ASSAY PRECISION

Three samples were assayed ten times each on the same calibration curve. The results (in pg/ml) are tabulated below:

Sample	Mean	SD	CV%
1	3.79	0.16	4.8
2	23.26	1.14	4.9
3	70.60	3.04	4.3

INTER-ASSAY PRECISION

Three samples were assayed ten times over a period of four weeks. The results (in pg/ml) are tabulated below:

Sample	Mean	SD	CV%
1	4.27	0.53	12.3
2	20.54	2.36	11.5
3	67.34	6.67	9.9

EXPECTED NORMAL VALUES

As for all clinical assays each laboratory should collect data and establish their own range of expected normal values. The following reference range (pg/ml) was established with 80 apparently healthy adults:

Group	N	Range (pg/ml)
Normal Euthyroid Samples	80	7-22

EFFECT OF BILIRUBIN

Bilirubin was added to a patient sample at concentrations of 50 and 100 µg/ml and assayed with the DIAsource Direct ft4 ELISA kit. Results are tabulated below:

Sample	ft4 (pg/ml)
Unspiked	8.78
+ 50 µg/ml bilirubin	10.68
+100 µg/ml bilirubin	9.72

No significant effect was observed at these concentrations.

EFFECT OF HUMAN SERUM ALBUMIN (HSA)

Purified human serum albumin (HSA) was added to a patient sample at concentrations of 10, 20 and 40 mg/ml. Samples were assayed with the DIAsource Direct ft4 ELISA kit. Results are tabulated below:

Sample	FT4 (pg/ml)
Unspiked	8.78
+10 mg/ml	8.81
+20 mg/ml	9.46
+40 mg/ml	9.90

No binding of labelled ft4 to HSA was found at these concentrations.

EFFECT OF THYROXINE-BINDING GLOBULIN (TBG)

The zero calibrator was spiked precisely with purified TBG at concentrations ranging from 25-200 µg/ml and assayed with the DIAsource Direct ft4 ELISA kit. Results are tabulated below:

Sample	TBG Added (µg/ml)	OD 450 nm
1	0	1.883
2	25	2.030
3	50	2.149
4	100	2.175
5	200	2.251

No significant binding of labelled ft4 to TBG was found at these concentrations.

EFFECT OF NON-ESTERIFIED FATTY ACIDS

Oleic acid was added to a patient sample at concentrations of 0.5, 5 and 20 mmol/L and assayed with the DIAsource Direct ft4 ELISA kit. Results are tabulated below:








Sample	ft4 (pg/ml)
Unspiked	24.83
+0.5 mmol/L	20.53
+5 mmol/L	26.06
+20 mmol/L	83.64

At high concentrations of oleic acid, the free T4 level was significantly increased. This is due to the well-known effect that non-esterified fatty acids can dissociate T4 from its carrier proteins.

REFERENCES

1. Ingbar, S.H. et al., J.Clin. Invest, 44:1679, 1965
2. Robins, J., Metabolism, 22(8):1021, 1973
3. Schall, R.F. J., Clin.Chem., 24(10):1801, 1978
4. Selenkow, H.A. and Robin, N.I., J.Maine Med. Assoc., 61:199, 1970
5. Oppenheimer, J.H. et. al. J. Clin. Invest., 42:1769, 1963
6. Young, D.S., et. al., Clin. Chem., 21:3640, 1975
7. Sterling, K., and Hegedus, A.J. Clin. Invest., 41:1031, 1962
8. Cavalieri, R.R., et. al., Clin. Res., 15:124, 1967
9. Comoglio, S. and Celada, F.J., Immunol. Meth., 10:161-170, 1976
10. McComb, R. B., Bowers, G.N., Posen, S., Alkaline Phosphatase, 1st Ed., Chap. 9, pg. 525-704, Plenum Press, New York, 1979

Revision date : 2011-02-25

	Used symbols
	Consult instructions for use
	Storage temperature
	Use by
LOT	Batch code
REF	Catalogue number
CONTROL	Control
I V D	In vitro diagnostic medical device
	Manufacturer
	Contains sufficient for <n> tests
WASH SOLN CONC	Wash solution concentrated
CAL 0	Zero calibrator
CAL N	Calibrator #
CONTROL N	Control #
Ag 1251	Tracer
Ab 1251	Tracer
Ag 1251 CONC	Tracer concentrated
Ab 1251 CONC	Tracer concentrated
	Tubes
INC BUF	Incubation buffer
ACETONITRILE	Acetonitrile
SERUM	Serum
DIL SPE	Specimen diluent
DIL BUF	Dilution buffer
ANTISERUM	Antiserum
IMMUNOADSORBENT	Immunoabsorbent
DIL CAL	Calibrator diluent
REC SOLN	Reconstitution solution
PEG	Polyethylene glycol
EXTR SOLN	Extraction solution
ELU SOLN	Elution solution
GEL	Bond Elut Silica cartridges
PRE SOLN	Pre-treatment solution
NEUTR SOLN	Neutralization solution
TRACEUR BUF	Tracer buffer
	Microtiterplate
Ab HRP	HRP Conjugate
Ag HRP	HRP Conjugate
Ab HRP CONC	HRP Conjugate concentrate
Ag HRP CONC	HRP Conjugate concentrate
CONJ BUF	Conjugate buffer
CHROM TMB CONC	Chromogenic TMB concentrate
CHROM TMB	Chromogenic TMB solution
SUB BUF	Substrate buffer
STOP SOLN	Stop solution
INC SER	Incubation serum
BUF	Buffer
Ab AP	AP Conjugate
SUB PNPP	Substrate PNPP
BIOT CONJ CONC	Biotin conjugate concentrate
AVID HRP CONC	Avidine HRP concentrate
ASS BUF	Assay buffer
Ab BIOT	Biotin conjugate
Ab	Specific Antibody
SAV HRP CONC	Streptavidin HRP concentrate
NSB	Non-specific binding
2nd Ab	2nd Antibody
ACID BUF	Acidification Buffer
DIST	Distributor