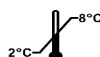


Instructions for use
25-OH Vitamin D (total) ELISA

REF**MS E-5800R****RUO**

For research
use only –
Not for use
in diagnostic
procedures

25-OH Vitamin D (total) ELISA

1. INTRODUCTION

1.1 Intended Use

The **25-OH Vitamin D (total) ELISA** is an enzyme immunoassay for the quantitative measurement of total 25-OH Vitamin D (Vitamin D₂ / D₃) in serum or plasma (EDTA, lithium heparin or citrate plasma).

2. PRINCIPLE OF THE TEST

The 25-OH Vitamin D (total) ELISA is a solid phase enzyme-linked immunosorbent assay (ELISA) based on the **principle of competitive binding**.

The microtiter wells are coated with a monoclonal (mouse) antibody directed towards a unique antigenic site of the 25-OH Vitamin D (25-OH D) molecule.

The sample is incubated together with Release Reagent in the wells to dissociate endogenous 25-OH D from Vitamin D binding protein (VDBP). Released 25-OH D then binds to the coated antibody of the well.

After a washing step, biotin-labeled 25-OH D (*Enzyme Conjugate*) and peroxidase-labeled streptavidin (*Enzyme Complex*) are added.

Added Biotin-25-OH D competes with endogenous 25-OH D for the binding to the coated antibody. Bound Biotin – 25-OH Vitamin D is then detected by Streptavidin-HRP.

After incubation, unbound components are washed off.

The amount of bound biotin-streptavidin complex is inversely proportional to the concentration of 25-OH Vitamin D in the sample.

Subsequently, substrate solution is added and the color development is stopped after a defined time.

The intensity of the color formed is inversely proportional to the 25-OH D concentration in the sample. The absorbance is measured at 450 nm with a microtiter plate reader.

3. WARNINGS AND PRECAUTIONS

1. This kit is for research use only.
2. All reagents of this test kit which contain human serum or plasma have been tested and confirmed negative for HIV I/II, HBsAg and HCV by FDA approved procedures. All reagents, however, should be treated as potential biohazards in use and for disposal.
3. Before starting the assay, read the instructions completely and carefully. Use the valid version of instructions for use provided with the kit. Be sure that everything is understood.
4. The microplate contains snap-off strips. Unused wells must be stored at 2 °C to 8 °C in the sealed foil pouch and used in the frame provided.
5. Pipetting of samples and reagents must be done as quickly as possible and in the same sequence for each step.
6. Use reservoirs only for single reagents. This especially applies to the substrate reservoirs. Using a reservoir for dispensing a substrate solution that had previously been used for the conjugate solution may turn solution colored. Do not pour reagents back into vials as reagent contamination may occur.
7. Mix the contents of the microplate wells thoroughly to ensure good test results. Do not reuse microwells.
8. Do not let wells dry during assay; add reagents immediately after completing the rinsing steps.
9. Allow the reagents to reach room temperature (21 °C to 26 °C) before starting the test. Temperature will affect the absorbance readings of the assay. However, values for the samples will not be affected.
10. Never pipet by mouth and avoid contact of reagents and specimens with skin and mucous membranes.
11. Do not smoke, eat, drink or apply cosmetics in areas where specimens or kit reagents are handled.
12. Wear disposable latex gloves when handling specimens and reagents. Microbial contamination of reagents or specimens may give false results.
13. Handling should be done in accordance with the procedures defined by an appropriate national biohazard safety guideline or regulation.
14. Do not use reagents beyond expiry date as shown on the kit labels.
15. All indicated volumes have to be performed according to the protocol. Optimal test results are only obtained when using calibrated pipettes and microtiter plate readers.
16. Do not mix or use components from kits with different lot numbers. It is advised not to exchange wells of different plates even of the same lot. The kits may have been shipped or stored under different conditions and the binding characteristics of the plates may result slightly different.
17. Avoid contact with Stop Solution containing 0.5 M H₂SO₄. It may cause skin irritation and burns.
18. Some reagents contain Proclin 300, BND and/or MIT as preservatives. In case of contact with eyes or skin, flush immediately with water.
19. TMB substrate has an irritant effect on skin and mucosa. In case of possible contact, wash eyes with an abundant volume of water and skin with soap and abundant water. Wash contaminated objects before reusing them. If inhaled, take the person to open air.
20. Chemicals and prepared or used reagents have to be treated as hazardous waste according to the national biohazard safety guideline or regulation.
21. For information on hazardous substances included in the kit please refer to Safety Data Sheets. Safety Data Sheets for this product are available upon request directly from the manufacturer.









4. REAGENTS

4.1 Reagents provided

MS E-5831  **Microtiterwells**

Content: 12 x 8 (break apart) strips, 96 wells;
Wells coated with anti-25-OH D antibody (monoclonal).

Standards and Controls – ready to use

Cat. no.	Component	Standard	Concentration	Volume/Vial
MS E-5801	 Standard A	Standard A	0 ng/ml	1 ml
MS E-5802	 Standard B	Standard B	5 ng/ml	1 ml
MS E-5803	 Standard C	Standard C	15 ng/ml	1 ml
MS E-5804	 Standard D	Standard D	30 ng/ml	1 ml
MS E-5805	 Standard E	Standard E	60 ng/ml	1 ml
MS E-5806	 Standard F	Standard F	120 ng/ml	1 ml
MS E-5851	 Control 1	Control 1	For control values and ranges please refer to vial label or QC-Report.	1 ml
MS E-5852	 Control 2	Control 2		1 ml

Conversion: 1 ng/ml = 2.5 nmol/l

Content: Contain non-mercury preservative.

The standards are calibrated against the following reference material: DEQAS No. 548.

MS E-5826  **Release Reagent** – ready to use

Content: Contains non-mercury preservative.

Volume: 1 x 20 ml

Hazards
identification:



H317 May cause an allergic skin reaction.

MS E-5840  **Enzyme Conjugate** – ready to use

Content: 25-OH D antigen conjugated with biotin;

Contains non-mercury preservative.

Volume: 1 x 7 ml

MS E-5841  **Enzyme Complex** – ready to use

Content: Streptavidin-Peroxidase Conjugate;

Contains non-mercury preservative.

Volume: 1 x 7 ml

FR E-0055  **Substrate Solution** – ready to use

Content: Tetramethylbenzidine (TMB).

Volume: 1 x 14 ml

FR E-0080  **Stop Solution** – ready to use

Content: Contains 0.5 M H₂SO₄.

Avoid contact with the stop solution. It may cause skin irritations and burns.

Volume: 1 x 14 ml

FR E-0030  **Wash Solution** – 40X concentrated

Volume: 1 x 30 ml

See „Reagent Preparation“.

Note: Additional *Standard A* for sample dilution is available upon request.

4.2 Materials required but not provided

- A microtiter plate calibrated reader (450 ± 10 nm)
- Calibrated variable precision micropipettes
- Absorbent paper
- Distilled or deionized water
- Incubator 37 °C (98.6 °F)
- Timer
- Graph paper or software for data reduction

4.3 Storage Conditions

When stored at 2 °C – 8 °C unopened reagents will retain reactivity until expiration date. Do not use reagents beyond this date.

Opened reagents must be stored at 2 °C – 8 °C. Microtiter wells must be stored at 2 °C – 8 °C. Once the foil bag has been opened, care should be taken to close it tightly again.

Opened kits retain activity for 8 weeks if stored as described above.

4.4 Reagent Preparation

Bring all reagents and required number of strips to room temperature prior to use.

Wash Solution

Add deionized water to the 40X concentrated Wash Solution.

Dilute 30 ml of concentrated *Wash Solution* with 1170 ml deionized water to a final volume of 1200 ml.

The diluted Wash Solution is stable for 1 week at room temperature.

4.5 Disposal of the Kit

The disposal of the kit must be made according to the national regulations. Special information for this product is given in the Safety Data Sheet, section 13.

4.6 Damaged Test Kits

In case of any severe damage to the test kit or components, the manufacturer has to be informed in writing, at the latest, one week after receiving the kit. Severely damaged single components should not be used for a test run. They have to be stored until a final solution has been found. After this, they should be disposed according to the official regulations.

5. SPECIMEN COLLECTION AND PREPARATION

Serum or plasma (EDTA, lithium heparin or citrate plasma) can be used in this assay.

Do not use haemolytic, icteric or lipaemic specimens.

Please note: Samples containing sodium azide should not be used in the assay.

5.1 Specimen Collection

Serum:

Collect blood by venipuncture (e.g. Sarstedt Monovette for serum), allow to clot, and separate serum by centrifugation at room temperature. Do not centrifuge before complete clotting has occurred. Donors receiving anticoagulant therapy may require increased clotting time.

Plasma:

Whole blood should be collected into centrifuge tubes containing anti-coagulant (e.g. Sarstedt Monovette with the appropriate plasma preparation) and centrifuged immediately after collection.

5.2 Specimen Storage and Preparation

Specimens should be capped and may be stored for up to 7 days at 2 °C – 8 °C prior to assaying.

Specimens held for a longer time (up to 12 months) should be frozen only once at -20 °C prior to assay.

Thawed samples should be inverted several times prior to testing.

5.3 Specimen Dilution

If in an initial assay, a specimen is found to contain more than the highest standard, the specimens can be diluted with *Standard A* and re-assayed as described in Assay Procedure.

For the calculation of the concentrations this dilution factor has to be taken into account.

Example:

a) dilution 1:10: 10 μ l sample + 90 μ l *Standard A* (mix thoroughly)

b) dilution 1:100: 10 μ l dilution a) 1:10 + 90 μ l *Standard A* (mix thoroughly).

6. ASSAY PROCEDURE

6.1 General Remarks

- All reagents and specimens must be allowed to come to room temperature before use. All reagents must be mixed without foaming.
- Once the test has been started, all steps should be completed without interruption.
- Use new disposal plastic pipette tips for each standard, control or sample in order to avoid cross contamination.
- Absorbance is a function of the incubation time and temperature. Before starting the assay, it is recommended that all reagents are ready, caps removed, all needed wells secured in holder, etc. This will ensure equal elapsed time for each pipetting step without interruption.
- As a general rule the enzymatic reaction is linearly proportional to time and temperature.

6.2 Test Procedure

Each run must include a standard curve.

1. Secure the desired number of microtiter wells in the frame holder.
2. Dispense 50 µl of each Standard, Control and sample <u>with new disposable tips</u> into appropriate wells.
3. Dispense 150 µl Release Reagent into each well. Thoroughly mix for 10 seconds. It is important to have a complete mixing in this step.
4. Incubate for 60 minutes at 37 °C .
5. Briskly shake out the contents of the wells. Rinse the wells 4 times with 400 µl diluted <i>Wash Solution</i> per well, if a plate washer is used - or - rinse the wells 4 times with 300 µl diluted <i>Wash Solution</i> per well for manual washing. Strike the wells sharply on absorbent paper to remove residual droplets. Important note: The sensitivity and precision of this assay is markedly influenced by the correct performance of the washing procedure!
6. Add 50 µl of Enzyme Conjugate to each well.
7. Add 50 µl of Enzyme Complex to each well.
8. Incubate for 30 minutes at 37 °C .
9. Briskly shake out the contents of the wells. Rinse the wells 4 times with 400 µl diluted <i>Wash Solution</i> per well, if a plate washer is used - or - rinse the wells 4 times with 300 µl diluted <i>Wash Solution</i> per well for manual washing. Strike the wells sharply on absorbent paper to remove residual droplets.
10. Add 100 µl of Substrate Solution to each well.
11. Incubate for 15 minutes at room temperature.
12. Stop the enzymatic reaction by adding 100 µl of Stop Solution to each well.
13. Determine the absorbance (OD) of each well at 450 ± 10 nm with a microtiter plate reader. It is recommended that the wells be read within 10 minutes after adding the Stop Solution.

6.3 Calculation of Results

1. Calculate the average absorbance values for each set of standards, controls and samples.
2. Using linear graph paper, construct a standard curve by plotting the mean absorbance obtained from each standard against its concentration with absorbance value on the vertical (Y) axis and concentration on the horizontal (X) axis.
3. Using the mean absorbance value for each sample determine the corresponding concentration from the standard curve.
4. Automated method: The results in the Instructions for Use have been calculated automatically using a 4-Parameter curve fit. (4 Parameter Rodbard or 4 Parameter Marquardt are the preferred methods.) Other data reduction functions may give slightly different results.
5. The concentration of the samples can be read directly from this standard curve. Samples with concentrations higher than that of the highest standard have to be further diluted or reported as that. For the calculation of the concentrations this dilution factor has to be taken into account.

6.3.1 Example of Typical Standard Curve

The following data is for demonstration only and **cannot** be used in place of data generations at the time of assay.

Standard	Optical Units (450 nm)
Standard A 0 ng/ml	2.10
Standard B 5 ng/ml	1.86
Standard C 15 ng/ml	1.51
Standard D 30 ng/ml	1.10
Standard E 60 ng/ml	0.57
Standard F 120 ng/ml	0.09

7. EXPECTED NORMAL VALUES

It is strongly recommended that each laboratory should determine its own normal and abnormal values.

In a study conducted with apparently healthy individuals (50% white Americans, 20% Hispanics and 30% Afro-Americans), using the 25-OH Vitamin D (total) ELISA the following data were observed:

Population	n	Age (years)	Mean (ng/ml)	Median (ng/ml)	2.5 th – 97.5 th Percentile (ng/ml)	Range (min. – max.) (ng/ml)
Males	92	10 – 83	21.49	18.66	5.58 – 56.83	5.39 – 58.33
Females	102	15 – 80	22.78	19.56	3.99 – 54.23	3.23 – 65.10
Summer	52	24 – 76	22.20	18.21	5.96 – 57.84	3.74 – 58.33
Winter	60	21 – 66	15.13	13.82	3.71 – 33.45	3.23 – 41.24

It is important for each laboratory to establish its own reference range, representative of its typical population. Factors such as UV exposure, season, race, and dietary intake are all known to affect concentrations of 25-OH Vitamin D in humans. A high prevalence of subclinical 25 OH Vitamin D deficiency has been noted in many countries, particularly in winter months.

A review of the literature suggests the following ranges for the classification of 25-OH Vitamin D status ³:

Vitamin D status	25-OH Vitamin D (ng/ml)	25-OH Vitamin D (nmol/l)
Deficiency	< 10	< 25
Insufficiency	10 – 29	25 – 72.5
Sufficiency	30 – 100	75 – 250
Toxicity	> 100	> 250

8. QUALITY CONTROL

Good laboratory practice requires that controls be run with each standard curve. A statistically significant number of controls should be assayed to establish mean values and acceptable ranges to assure proper performance.

It is recommended to use control samples according to state and federal regulations. The use of control samples is advised to assure the day to day validity of results. Use controls at both normal and pathological levels.

The controls and the corresponding results of the QC-Laboratory are stated in the QC-Report added to the kit. The values and ranges stated on the QC sheet always refer to the current kit lot and should be used for direct comparison of the results.

It is also recommended to make use of national or international Quality Assessment programs in order to ensure the accuracy of the results.

Employ appropriate statistical methods for analysing control values and trends. If the results of the assay do not fit to the established acceptable ranges of control materials results should be considered invalid.

In this case, please check the following technical areas: Pipetting and timing devices; photometer, expiration dates of reagents, storage and incubation conditions, aspiration and washing methods.

After checking the above mentioned items without finding any error contact your distributor or the manufacturer directly.

9. PERFORMANCE CHARACTERISTICS

9.1 Assay Dynamic Range

The range of the assay is between 3.22 – 120 ng/ml.

9.2 Specificity of Antibodies (Cross-Reactivity)

The cross-reactivity is determined according to the Method of Abraham⁸.

The following substances were tested for cross-reactivity of the assay:

Substance	Added conc. (ng/ml)	Mean cross-reactivity (%)
25-OH Vitamin D ₃	15 – 120	99.50
25-OH Vitamin D ₂	1.56 – 12.50	97.43
1,25 (OH) ₂ Vitamin D ₃	12 – 12000	0.98
1,25 (OH) ₂ Vitamin D ₂	12 – 12000	0.16
Vitamin D ₃	12 – 12000	13.36
Vitamin D ₂	12 – 12000	0.96
3-Epi-25-OH Vitamin D ₃	12 – 12000	0.83

9.3 Sensitivity

The Limit of Blank (LoB) is 2.219 ng/ml.

The Limit of Detection (LoD) is 3.224 ng/ml.

The Limit of Quantification (LoQ) is 3.750 ng/ml.

9.4 Reproducibility

9.4.1 Intra Assay

The within assay variability was determined by measuring each sample 10 times per run (n = 10):

Sample	N	Mean (ng/ml)	CV (%)
1	10	15.92	6.3
2	10	30.91	4.0
3	10	80.90	3.1
4	10	106.94	1.5

9.4.2 Inter Assay

The between assay variability was determined by measuring each sample 10 times per run for 3 days (n = 30):

Sample	N	Mean (ng/ml)	CV (%)
1	30	16.87	10.2
2	30	31.26	7.7
3	30	81.49	8.4
4	30	108.83	2.2

9.5 Recovery

Samples have been spiked by adding 25-OH Vitamin D solutions with known concentrations.

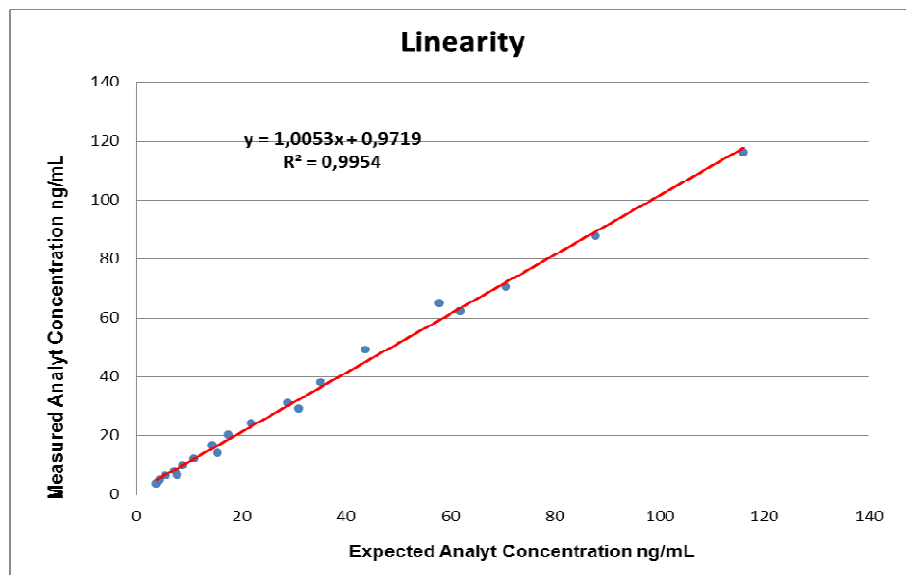
The recovery (%) was calculated by multiplying the ratio of measured and expected values with 100.

	Sample 1	Sample 2	Sample 3	Sample 4	
Concentration (ng/ml)	13.30	22.00	40.30	60.00	
Average Recovery (%)	98.6	101.6	97.3	106.7	
Range of Recovery (%)	from	94.6	97.1	89.6	100.0
	to	104.5	104.5	107.7	109.7

9.6 Linearity

Samples were measured undiluted and in serial dilutions from 1:2 to 1:16 with *Standard A*. The recovery (%) was calculated by multiplying the ratio of expected and measured values with 100.

		Sample 1	Sample 2	Sample 3	Sample 4
Concentration (ng/ml)		17.14	62.00	87.70	116.00
Average Recovery (%)		104.0	89.7	111.4	110.8
Range of Recovery (%)	from	85.2	85.2	109.5	106.9
	to	111.8	93.5	114.9	113.8



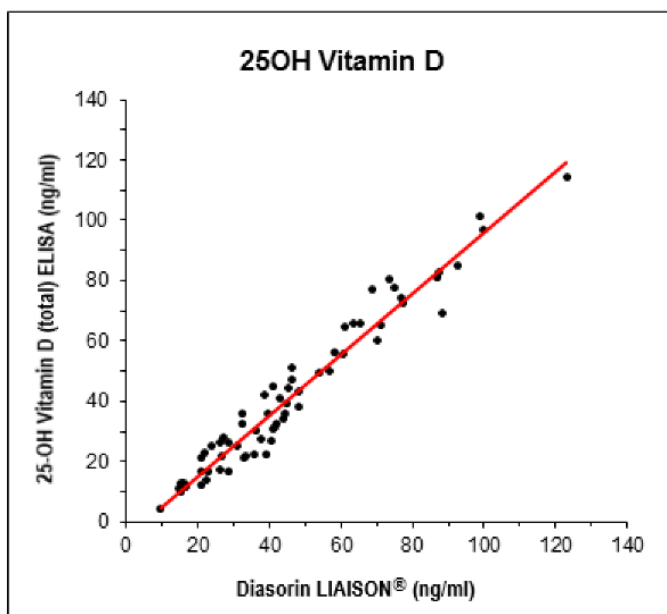
9.7 Comparison Studies

A comparison of 25-OH Vitamin D (total) ELISA (y) and the reference method LIAISON® 25-OH Vitamin D total (Diasorin) (x) using samples gave the following correlation:

n = 67

r = 0.976

y = 1.010x - 4.814



10. LIMITATIONS OF USE

Reliable and reproducible results will be obtained when the assay procedure is performed with a complete understanding of the package insert instruction and with adherence to good laboratory practice. Any improper handling of samples or modification of this test might influence the results.

10.1 Interfering Substances

Serum, EDTA and citrate plasma:

Haemoglobin (up to 4 mg/ml), bilirubin (up to 0.5 mg/ml) and triglyceride (up to 7.5 mg/ml) have no influence on the assay results.

Li-heparin plasma:

Haemoglobin (up to 0.5 mg/ml), bilirubin (up to 0.5 mg/ml) and triglyceride (up to 7.5 mg/ml) have no influence on the assay results.

Note: Sample concentration will decrease by more than 20% at haemoglobin concentrations > 0.5 mg/ml.

A biotin concentration of up to 1200 ng/ml in a sample has no influence on the assay results.

10.2 Drug Interferences

Until today no substances (drugs) are known to us, which have an influence to the measurement of 25-OH Vitamin D in a sample.

10.3 High-Dose-Hook Effect

A High-Dose-Hook Effect is not known for competitive assays.

11. LEGAL ASPECTS

11.1 Reliability of Results

The test must be performed exactly as per the manufacturer's instructions for use. Moreover the user must strictly adhere to the rules of GLP (Good Laboratory Practice) or other applicable national standards and/or laws. This is especially relevant for the use of control reagents. It is important to always include, within the test procedure, a sufficient number of controls for validating the accuracy and precision of the test.

The test results are valid only if all controls are within the specified ranges and if all other test parameters are also within the given assay specifications. In case of any doubt or concern please contact the manufacturer.

11.2 Liability













Any modification of the test kit and/or exchange or mixture of any components of different lots from one test kit to another could negatively affect the intended results and validity of the overall test. Such modification and/or exchanges invalidate any claim for replacement.

Claims submitted due to customer misinterpretation of laboratory results subject to point 11.2 are also invalid. Regardless, in the event of any claim, the manufacturer's liability is not to exceed the value of the test kit. Any damage caused to the test kit during transportation is not subject to the liability of the manufacturer.

12. REFERENCES / LITERATURE

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Symbols:

	Storage temperature		Manufacturer		Contains sufficient for <n> tests
	Use-by date		Batch code		
	Consult instructions for use		Content		
	Caution		Catalogue number		Distributor
	Date of manufacture				For research use only!